

JPRS-UEE-85-005

27 March 1985

USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING



FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service (NTIS), Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semimonthly by the NTIS, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

Soviet books and journal articles displaying a copyright notice are reproduced and sold by NTIS with permission of the copyright agency of the Soviet Union. Permission for further reproduction must be obtained from copyright owner.

27 March 1985

USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

CONTENTS

ACOUSTICS SPEECH AND SIGNAL PROCESSING

Field of Point Source of Low-Frequency Sound in Atmosphere With Altitudinally Nonuniform Wind (I. P. Chunchuzov; AKUSTICHESKIY ZHURNAL, No 4, Jul-Aug 84).....	1
Wave Description of Sound Propagation Through Stratified Moving Atmosphere (V. Ye. Ostashev; AKUSTICHESKIY ZHURNAL, No 4, Jul-Aug 84).....	2
Surface Acoustic Wave Structure and Volume Waves (V. I. Anisimkin, I. M. Kotelyanskiy, et al.; AKUSTICHESKIY ZHURNAL, No 4, Jul-Aug 84).....	2
Effect of Axisymmetric Vibration Modes on Sensitivity and Directivity Characteristics of Piezoceramic Sphere (M. Ye. Dyubchenko; AKUSTICHESKIY ZHURNAL, No 4, Jul-Aug 84).....	3
Sound Emission by Particle Beam Passing Through Hole in Rigid Shield (V. I. Pavlov, A. I. Sukhorukov; AKUSTICHESKIY ZHURNAL, No 4, Jul-Aug 84).....	4
Recording of Acoustic Wave in Gaseous Medium With Thin-Film Pyroelectric Transducers (S. V. Belyayev, V. M. Gorelik, et al.; AKUSTICHESKIY ZHURNAL, No 4, Jul-Aug 84).....	5
Space Processing of Acoustic Signals in Plane-Parallel Waveguide (A. Ya. Kalyuzhnyy, L. G. Krasnyy, et al.; AKUSTICHESKIY ZHURNAL, No 4, Jul-Aug 84).....	6

System of Phase-Lock Automatic Frequency Control With Acoustoelectronic Convolver (V. M. Tarasov, S. I. Brygin; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84)...	6
Psychological and Physiological Basis of Stereophonic Effect (A. P. Yefimov; ELEKTROSVYAZ', No 10, Oct 84).....	7
ANTENNAS AND PROPAGATION	
Interference Immunity of Optical Radar System With Phased Antenna Array (Ya. V. Alishev, V. Ye. Yamaykin; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84)...	8
Cophasal Horizontal Wideband Array Antennas for Transmitters With Asymmetric Output (S. P. Belousov, G. A. Kliger, et al.; ELEKTROSVYAZ', No 9, Sep 84).....	9
Antenna With Outboard Exciter for 3.4-13.25 GHz Frequency Range (A. A. Timofeyeva, I. A. Kozlovskaya, et al.; ELEKTROSVYAZ', No 8, Aug 84).....	9
BROADCASTING; CONSUMER ELECTRONICS	
Converters of Sum/Difference of Codes to Frequency (G. L. Sedletskiy; ELEKTROSVYAZ', No 8, Aug 84).....	11
Analysis of Spectral Characteristics of Multilevel Digital Computing Synthesizers (S. Ya. Shishov, N. P. Yampurin; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84)...	12
Evaluation of Influence of Quantization Precision on Effectiveness of Signal Discrimination in the Presence of Correlation Noise (A. I. Rog, A. A. Sirota; IZVESTIYA VYSSHIKH UCHIBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	12
Adaptive Detection of Noise Signal According to Neumann- Pearson Criterion (Yu. A. Padiyakov; IZVESTIYA VYSSHIKH UCHIBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	13
Transient Processes in Tuned Amplifier During Phase-Shift Keying With Smooth Phase Variation (N. A. Kamalyayev; ELEKTROSVYAZ', No 11, Nov 84).....	14

Apparatus for Checking Connection Lines in Urban Telephone Networks	
(V. K. Koshelev, Z. M. Slavin, et al.; ELEKTROSVYAZ', No 8, Aug 84).....	14
Automation of Servicibility of Radio-Relay Station Equipment	
(A. G. Ur'yev, Ye. I. Mishin, et al.; ELEKTROSVYAZ', No 8, Aug 84).....	15
System of Light Protection of Antenna-Mast Structures of Radio Relay Lines	
(V. Ye. Larin, Ye. V. Martynov, et al.; ELEKTROSVYAZ', No 8, Aug 84).....	15
How To Grow Accustomed to Wire Broadcasting?	
(I. A. Shamshin; ELEKTROSVYAZ', No 9, Sep 84).....	16
Modern Stereophonic Studio Equipment	
(I. V. Ruzanov, A. V. Nikonov, et al.; ELEKTROSVYAZ', No 10, Oct 84).....	17
"Horizon Ts-257"	
(V. Roginkin, V. Sukhodol'skiy, RADIO, No 11, Nov 84)....	17
Outlook for Development of Cables for Rural Telephone Networks	
(ELEKTROSVYAZ', No 8, Aug 84).....	18
To Increase the Efficiency of Utilization of Trunks	
(A. P. Yefimov, I. A. Baglarov, et al.; VESTNIK SVYAZI, No 11, Sep 84).....	18
CIRCUITS AND SYSTEMS	
New Large-Scale Circuit Integration for Communication Systems	
(G. A. Boldyrev, V. P. Zakharov, et al.; ELEKTROSVYAZ', No 8, Aug 84).....	20
Monolithic Quartz Filters for Extraction of Clock Frequency in Digital Communication Systems	
(S. V. Petryakov, Yu. V. Kachal'nikov; ELEKTROSVYAZ', No 9, Sep 84).....	20
Two-Mode Dielectric-Waveguide Filters With Elliptical Amplitude-Frequency Characteristic	
(M. N. Berger, A. A. Ishchuk, et al.; ELEKTROSVYAZ', No 9, Sep 84).....	21
Normalizing Characteristics of Multichannel Limiters for Phase-Code-Modulated Signals	
(M. M. Leshchinskiy, V. Yu. Lezin; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84)...	22

Estimation of Spectrum Parameters and Discrimination of Random Signals by Means of Acoustooptic Spectrum Analyzer in Presence of Internal Noise and External Interference (G. S. Nakhmanson; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	22
Realization of Multistage Structure for 60-Channel Transmultiplexer (A. V. Brunchenko; ELEKTROSVYAZ', No 8, Aug 84).....	23
Multifunctional Indicator (D. Luk'yanov; RADIO, No 11, Nov 84).....	24
COMMUNICATIONS	
Digital Information Transmission-Problems and Tendencies of Development (V. O. Shvartsman; ELEKTROSVYAZ', No 11, Nov 84).....	25
Technical and Economic Characteristics of Multiwire Coaxial Deeply-Cooled Cables. (V. T. Fedin, V. M. Goncharov; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA, No 12, Dec 84).....	26
Relays With Hermetically Sealed Memory Contacts (L. I. Rabkin, V. A. Drachev, et al.; ELEKTROSVYAZ', No 8, Aug 84).....	26
Interference Immunity of Coherent Phase-Keyed-Signal Demodulator With Optimum Clock Synchronizer and Ideal Detector (V. K. Raskin; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	27
Testing Multichannel Modulator-Demodulator in Decametric-Wave Radio Channels (K. K. Venskauskas, V. I. Dmitriyev, et al.; ELEKTROSVYAZ', No 11, Nov 84).....	28
Suppression of Pulse Interference by Blanking for Group Transmission of Binary Code (V. A. Vershinin, V. S. Lando; ELEKTROSVYAZ', No 11, Nov 84).....	29
Interference Immunity of Binary Signals in Markov Channel With Fading (V. V. Bortnikov; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	29

Encoding and Decoding of Stereophonic Signals in System With Polar Modulation (P. M. Zhmurin; ELEKTROSVYAZ', No 10, Oct 84).....	30
Some Development Trends in Electrical Communication (G. P. Zakharov; ELEKTROSVYAZ', No 10, Oct 84).....	30
Frequency Selection for Dispersion Signal in Satellite Communication Lines (V. M. Dorofeyev; ELEKTROSVYAZ', No 9, Sep 84).....	31
Improvement of Public Telegraph System by Introduction of Message Switching Centers (K. S. Zhevlyuk, R. A. Tuykin; ELEKTROSVYAZ', No 9, Sep 84).....	32
Method of Remote Inspection of Subscriber Lines in Rural Telephone Network (S. M. Granat, E. K. Yelekoyeva; ELEKTROSVYAZ', No 9, Sep 84).....	32
Design of Communication Networks With Alternate Routes Having Noncoincident Peak Load Hours (V. N. Vrazhnov, V. M. Dubrovinskiy; ELEKTROSVYAZ', No 9, Sep 84).....	33
Test Results on K-1920P Line Channel Equipment (I. M. Butlitskiy, O. G. Gedovius, et al.; ELEKTROSVYAZ', No 11, Nov 84).....	34
Electric Power Supply for Equipment in Line Channel of K-1020S Transmission System (N. M. Sergeycheva; ELEKTROSVYAZ', No 8, Aug 84).....	34
K-10800 Transmission System (Ye. S. Mamonov, A. V. Lebedev, et al.; ELEKTROSVYAZ', No 8, Aug 84).....	35
Interactive Method of Secondary Communication Network Rational Graph Synthesis (V. S. Mikheyenko; ELEKTROSVYAZ', No 9, Sep 84).....	36
Market Research Dealing With Urban Telephone System Subscribers' Interest in Additional Services (N. A. Akhmedov, N. B. Pokrovskiy; ELEKTROSVYAZ', No 8, Aug 84).....	36
Selection of Frequency Conversion for Quasi-Optimum Adaptation Algorithm in Frequency Domain (O. N. Galchenkov; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	37

New Multiprogram UHF FM Radio Station 'Dozhd'-4' for Stereo-Phonic Broadcasting (L. B. Kalinin, S. G. Monzeler; ELEKTROSVYAZ', No 10, Oct 84).....	38
Design of Experimental Digital Radio Relay System for Transmission of Stereophonic and Monophonic Broadcasts (N. I. Guk, I. M. Dvoretzkiy, et al.; ELEKTROSVYAZ', No 10, Oct 84).....	38
Method of Calculating Crosstalk Noise in Radio Relay Links by Harmonic Analysis of Frequency Characteristic Group Lag Time (L. S. Tartakovskiy; ELEKTROSVYAZ', No 8, Aug 84).....	39
Selection of Predistortion and Restoration Circuits for Encoder-Decoder Equipment in Digital Transmission Systems With Pulse-Code-Modulated Broadcast Signals (A. V. Vykhodets, V. I. Denisov, et al.; ELEKTROSVYAZ', No 10, Oct 84).....	40
Some Problems in Development of Stereophonic Radio Broadcasting (A. M. Varbanskiy; ELEKTROSVYAZ', No 10, Oct 84).....	41
Trends in Development of Stereophonic Radio Broadcasting in USSR (G. Z. Yushkyavichyus, V. I. Khlebnikov, et al.; ELEKTROSVYAZ', No 10, Oct 84).....	42
Prospective Network of Stereophonic Channels for Sound Broadcasting (R. A. Kotikova, Ye. G. Mishina, et al.; ELEKTROSVYAZ', No 10, Oct 84).....	42
Stereophonic Broadcasting Network in Latvian SSR (I. Ya. Yekabson, S. V. Pankin, et al.; ELEKTROSVYAZ', No 10, Oct 84).....	43
Stereophonic Radio Broadcasting Systems (L. M. Kononovich; ELEKTROSVYAZ', No 10, Oct 84).....	44
'Interkosmos' Program of Space Communication Development (L. Ya. Kantor; ELEKTROSVYAZ', No 9, Sep 84).....	45
Preliminary Estimation of Mutual Interference Between Fixed Satellite Service Systems (S. V. Borodich; ELEKTROSVYAZ', No 9, Sep 84).....	45
Radio Communication for Subway Operation and Engineering Services (Yu. V. Vavanov, E. B. Kameneva, et al.; AVTOMATIKA, TELEMEXHANIKA I SVYAZ', No 10, Sep 84).....	46

Equipment for Testing Locomotive Signaling Devices (I. A. Zdorovtsov, D. N. Khromushkin, et al.; AVTOMATIKA, TELETEKHNIKA I SVYAZ', No 10, Sep 84).....	47
Application of Simplified Functional Circuits for Traffic Control at ESK 400E Station (S. I. Khrumchenkov; AVTOMATIKA, TELETEKHNIKA I SVYAZ', No 10, Sep 84).....	48
Device for Measuring Parameters of the Long-Distance Automatic Communication Sets (Ye. M. Gulya, V. I. Bugayenko; AVTOMATIKA, TELETEKHNIKA I SVYAZ', No 10, Sep 84).....	49
Increasing the Efficiency and Quality of Operation of the Railroad Engineering Maintenance Administration. (A. A. Konovalenko; AVTOMATIKA, TELETEKHNIKA I SVYAZ', No 10, Sep 84).....	49
"Sporting" Radio Receiver Conversion From R-250 M (Yu. Kurinyy; RADIO, No 11, Nov 84).....	50
Survey of Developments in Tropospheric Communication Apparatus (A. S. Nemirovskiy, V. V. Markov; ELEKTROSVYAZ', No 11, Nov 84).....	50
Automatic Number Identification Equipment For Rural Automatic Telephone Exchanges (V. V. Khonin, A. N. Shifman; VESTNIK SVYAZI, No 11, Sep 84).....	51
New Technology for Recording Long-Distance Telephone Conversations With ARM-20 Units (V. F. Lyulin, N. I. Tolstonogov, et al.; VESTNIK SVYAZI, No 11, Sep 84).....	52

COMPONENTS, HYBRIDS AND MANUFACTURING TECHNOLOGY

Evaluation of Adequacy of JP54 Protection Level for Large Electric Machines (L. A. Zbarskiy, B. Ye. Teplitskiy, et al.; PROMYSHLENNAYA ENERGETIKA, No 10, Oct 84).....	53
Method of Improving Dynamic Characteristics of D.C. Voltage Stabilizers With Compound Regulation (G. S. Stoyanov, L. F. Zakharov; ELEKTROSVYAZ', No 8, Aug 84).....	54

Calculation of Noise Factor for Cascade Wideband Amplifiers (V. P. Valyukhov, V. D. Kuptsov, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	54
Quality Control of Radioelectronic Apparatus Components on Basis of External Characteristics in Frequency Domain (F. N. Pokrovskiy; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	55
Cascode and Differential Amplifier Using Field-Effect Transistors (N. Polyakov; RADIO, No 11, Nov 84).....	55
COMPUTERS	
Structurization of Programs for Real-Time Microprocessor Arrays (B. M. Rakhimbekov, A. N. Varfolomeyev; ELEKTROSVYAZ', No 9, Sep 84).....	57
ELECTRON DEVICES	
Acoustic Emission in Semiconductor Devices During Current Flow (V. A. Kalitenko, I. Ya. Kucherov, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	58
Computer-Aided Identification of Complete Constitution Model of Transistor Structure for Design of Subnanosecond Large- Scale-Integrated Circuits (A. N. Bubennikov, A. D. Sadovnikov; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	59
INSTRUMENTATION AND MEASUREMENTS	
Instrument for Measuring Dispersional Distortions in Optical Fibres and Cables (Ya. V. Alishev, A. A. Mar'yenkov, et al.; ELEKTROSVYAZ', No 9, Sep 84).....	60
Measurement of Coupling Admittance of Cylindrical Shields (V. K. Lipskiy; ELEKTROSVYAZ', No 9, Sep 84).....	61
MICROWAVE THEORY AND TECHNIQUES	
Nonreciprocal Two-Channel Microwave Power Dividers and Adders (M. V. Vamberskiy, V. P. Usachov, et al.; IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA, No 10, Oct 84).....	62

POWER ENGINEERING

Change in Technical and Economic Indicators of Power Systems When Operating at Lower Frequency (V. R. Okorokov, T. I. Polikarpova; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA, No 11, Nov 84).....	63
Control and Maintenance of Electric Power Quality--as Important Item in Economization of Fuel and Energy Resources (V. S. Kakhanovich, A. S. Vershinin; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA, No 11, Nov 84).....	64
Ensuring Electrical Safety in Mobile Electric Power Plants (A. A. Buralkov; IZVESTIYA VYSSHIKH UCHIBNIKH ZAVEDENIY: ENERGETIKA, No 11, Nov 84).....	65
Parameters of Compact Controllable Two-Circuit Electric Power Transmission Lines of Concentric Structure (G. Ye. Pospelov, V. T. Fedin, et al.; IZVESTIYA VYSSHIKH UCHIBNIKH ZAVEDENIY: ENERGETIKA, No 11, Nov 84).....	65
Vibration of Wires of Split Phase Electric Power Lines (V. I. Van'kov; IZVESTIYA VYSSHIKH UCHIBNIKH ZAVEDENIY: ENERGETIKA, No 12, Dec 84).....	66
Investigation of Developing a Series of Wideband Voltage Dividers Using Microwire (O. V. Grimal'skiy, V. L. Ivanov; IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA, No 12, Dec 84).....	67
Organization of Planning and Managing Efficiency Use of Fuel and Energy Resources (V. V. Savchenko, Yu. A. Tikhomirov; PROMYSHLENNAYA ENERGETIKA, No 10, Oct 84).....	68
Use of Secondary Energy Sources as Important Factor in Energy Conservation by Industry (S. P. Sushon, A. G. Zavalko, et al.; PROMYSHLENNAYA ENERGETIKA, No 10, Oct 84).....	68
Ways To Use Secondary Energy Sources by Chemical Industries (V. V. Zhizhin, D. I. Kharaz; PROMYSHLENNAYA ENERGETIKA, No 10, Oct 84).....	69
Main Trends in Fuel and Energy Economization by Petroleum Processing and Petrochemical Industry (G. M. Yermolov, S. M. Zen'kovskiy, et al.; PROMYSHLENNAYA ENERGETIKA, No 10, Oct 84).....	70

QUANTUM ELECTRONICS/ELECTRO-OPTICS

- Determination of Twist Parameters Which Decrease Intermodulation Dispersion in Single-Mode Optical Fiber
(S. I. Ivanov, T. A. Tvoremirova; ELEKTROSVYAZ', No 9, Sep 84)..... 71

NEW ACTIVITIES, MISCELLANEOUS

- Thirty-Ninth All-Union Meeting Devoted To Radio Day
(L. N. Ishutina; ELEKTROSVYAZ', No 8, Aug 84)..... 72
- Conference of Experts in Communication Administration--Members of Organization for Cooperation of Socialist Countries in the Field of Telecommunication and Postal Service
(V. G. Yampol'skiy; ELEKTROSVYAZ', No 8, Aug 84)..... 72
- To Increase Efficiency of Brigade Form of Organization and Renumerization of Labor
(V. N. Lebedev; VESTNIK SVYAZI, No 11, Sep 84)..... 73
- Digital Technique in Radio Broadcasting
(M. V. Gitlits; ELEKTROSVYAZ', No 9, Sep 84)..... 74
- Regional Seminar on Problems of Synchronization
(A. V. Pestryakov; ELEKTROSVYAZ', No 9, Sep 84)..... 74

ACOUSTICS SPEECH AND SIGNAL PROCESSING

UDC 534.221.1

FIELD OF POINT SOURCE OF LOW-FREQUENCY SOUND IN ATMOSPHERE WITH
ALTITUDINALLY NONUNIFORM WIND

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 4, Jul-Aug 84
(manuscript received 24 Dec 82) pp 546-552

CHUNCHUZOV, I. P.

[Abstract] The problem of propagation of infrasonic waves from a point source through a stratified moving atmosphere is solved almost exactly, analytically, for the case of an altitudinally nonuniform purely horizontal wind. The harmonic point source is assumed to be close to or on the ground and the wind velocity is assumed to vary vertically with an exponential profile

$$\frac{V_x(z)}{c} = \frac{V_0}{c} (1 - e^{-z/h}) \quad (V - \text{horizontal wind velocity, } c - \text{acoustic velocity,}$$

h - characteristic scale of altitudinal wind nonuniformity). The corresponding equation for the "quasi-potential" velocity is solved for the altitudinal amplitude profiles of the zero-order normal wave in a narrow atmospheric waveguide ($k_0 h = 1$) and in a wide atmospheric waveguide ($k_0 h = 2\pi$), as well as of the third-order normal wave ($k_0 h = 22$) and the sixth-order normal wave ($k_0 h = 40$). From the solution is also determined the dependence of the wave field amplitude and phase on the distance from the source. Results are based on

on $k_0 h \gg \frac{V_x}{c}$ (k_0 - wave number) and $V_x \ll c$, with $h = 30 \text{ m} \sim \lambda$ (λ - wavelength of sound). The author thanks V. M. Bovsheverov and V. I. Tatarskiy for helpful discussions during the work. Figures 6; references 7; 6 Russian, 1 Western (in Russian translation).
[120-2415]

WAVE DESCRIPTION OF SOUND PROPAGATION THROUGH STRATIFIED MOVING ATMOSPHERE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 4, Jul-Aug 84
(manuscript received 21 Feb 83) pp 521-526

OSTASHEV, V. Ye., Institute of Atmospheric Physics, USSR Academy of Sciences

[Abstract] The sound pressure field in a stratified moving atmosphere is calculated on the basis of the corresponding one-dimensional Helmholtz equation. This method is applied to the two particular cases of 1): A finite sound source outside the moving air and 2) Of a monochromatic point source moving inside the moving air at some other velocity. With the equation of continuity linearized for each case, solution of the Helmholtz equation yields the spectral density of sound pressure. The sound pressure field is obtained from the latter upon evaluation of the Fourier integral. For the sound pressure, the spatially uniform high-frequency asymptote of the solution yields an expression which contains two constants and the Airy function of a negative argument. The results thus differ from those for a still atmosphere by including an extra amplitude factor and a vertical wave number dependent on the wind profile. The altitude of the reversal point also depends on the wind profile. The validity of geometrical acoustics in the case of a moving medium is established for the waveguide part of sound pressure and found to depend on the ratio of wind velocity to sound velocity as well as on the inclination angle of the wave vector to the horizontal. The author thanks V. I. Tatarskiy for attention to the work and helpful discussions. References 6: 5 Russian, 1 Western.
[120-2415]

UDC 534.286.534.16+543.0:543.26

SURFACE ACOUSTIC WAVE STRUCTURE AND VOLUME WAVES

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 4, Jul-Aug 84
(manuscript received 17 Dec 82) pp 417-423

ANISTINKIN, V. I., KOTELYANSKIY, I. M. and MAGONEDOV, M. A., Institute of Radio Engineering and Electronics, USSR Academy of Sciences

[Abstract] A surface acoustic wave in an anisotropic single crystal and three volume waves (longitudinal, fast transverse, slow transverse) propagating through it in the same crystallographic direction are examined, for the purpose of determining the optimum crystal cut for acoustoelectronic devices. The structural characteristics of a surface acoustic wave are ellipticity of surface displacement, depth of localization, and amplitude of its vertical component. The propagation characteristics of volume waves are their polarizations and velocities. An analysis of all these waves and their characteristics in crystals with various lattice symmetries (cubic, hexagonal,

trigonal, tetragonal) reveals that, regardless of the symmetry, each different displacement ellipse in a surface acoustic wave corresponds to a definite disposition of the triad of mutually orthogonal partial displacement components in that surface acoustic wave. The shape of the displacement ellipse in a surface acoustic wave and its orientation relative to the sagittal plane correlate with the directions of displacements in the three volume waves and with the velocities of the latter. Moreover, the localization depth of a surface acoustic wave and the amplitude of its largest partial component correlate with the ratio of SAW (surface acoustic wave) velocity to STWV (slow transverse volume wave) velocity. All these correlations are attributable to the mechanism of SAW formation through transformation of volume waves under specific boundary constraints in single crystals, according to data on KCl, PbS, $\text{Bi}_{12}\text{GeO}_{20}$, $\text{MgO} \cdot \text{Al}_2\text{O}_3$, Ni, InSb, GaAs, Ge, Si, diamond, YGa³, YIG, YAG, GGG crystals and variously cut (ZX, YX, YZ, XZ, XY, YX) LiNbO_3 , Al_2O_3 , SiO_2 , TiO_2 crystals. Deficiencies of this method of analysis are that the velocity of a surface acoustic wave is assumed to be known and that it does not cover all ellipses. It also does not distinguish between a superficial volume wave and a Gulyayev-Bluestein surface acoustic wave. The authors thank Yu. V. Gulyayev for valuable comments. Figures 3; tables 2; references 7: 5 Russian, 2 Western (1 in Russian translation). [120-2415]

UDC 534.612

EFFECT OF AXISYMMETRIC VIBRATION MODES ON SENSITIVITY AND DIRECTIVITY CHARACTERISTICS OF PIEZOCERAMIC SPHERE

Moscow *AKUSTICHESKIY ZHURNAL* in Russian Vol 30, No 4, Jul-Aug 84
(manuscript received 24 Dec 81, after correction 28 Jun 83) pp 477-481

DYUBCHENKO, M. Ye., Odessa Polytechnic Institute

[Abstract] The performance of a piezoceramic hydrophone sphere with a hole for the electric cable is analyzed, taking into account the axisymmetric vibration modes and the resulting stresses produced by the cutout but assuming that a seal cover restores the spherical symmetry and does not alter the natural modes. The spherical shell is, in the first approximation, a mechanically homogeneous one and contains, usually inside, a potential electrode with a piezoelectrically passive zone equivalent to a detached spherical shell segment congruent with the cover seal. The analysis is based on the corresponding equation of electromechanical state for such a sphere in the field of a plane sound wave. Conditions are established, in terms of constraints on the "capacitor" plates, for excitation of odd-order and even-order (including zero-order) axisymmetric modes. The sensitivity and the radiation pattern of such a hydrophone are calculated for a thin spherical shell (radius 23.5 mm, thickness 3 mm) with or without a passive zone (meridional angle 49° or 0° , respectively). A comparison of theoretical results with experimental data obtained at four different frequencies (15, 19.5, 26, 35.6 kHz) indicates that minimization of the

effect of axisymmetric modes will result in a maximally isotropic nondirectional hydrophone, a passive zone with a smaller than 20° meridional angle being both adequate and feasible. Figures 5; references 4: 2 Russian, 2 Western (in Russian translation).
[120-2415]

UDC 534.874.3

SOUND EMISSION BY PARTICLE BEAM PASSING THROUGH HOLE IN RIGID SHIELD

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 4, Jul-Aug 84
(manuscript received 3 Feb 83) pp 527-531

PAVLOV, V. I. and SUKHORUKOV, A. I., Moscow State University
imeni M. V. Lomonosov

[Abstract] Sound emission by a particle beam passing through a hole in an acoustically rigid plane shield is analyzed, assuming a thermal mechanism of partial energy transfer from particles in the beam to particles of the ambient medium and assuming a uniform rate of heat release along the path of a beam particle. The fundamental system of corresponding equations of acoustics is reduced to the wave equation for the velocity potential, and a Fourier transformation of the latter with respect to time yields a non-homogeneous Helmholtz equation for the spectral characteristics of sound emission. Its solution is the sum of two parts, the particular solution describing the field of sound sources and the general solution satisfying the homogeneous Helmholtz equation. Differentiation of the integral equivalent of that general solution in the plane of the shield and establishment of the boundary conditions on the basis of the particular solution yield the angular distribution of the spectral density of radiation energy and the dependence of that distribution on two parameters:

$$\xi = k \frac{R}{N} \sqrt{1 - M^2},$$

$$\eta = \frac{M\theta}{\sqrt{1 - M^2}} \quad (M - \text{Mach number, } \theta - \text{angle between line of observation and}$$

direction of beam propagation, k - wave number, R - radius of circular hole).
Figures 2; references: 5 Russian.
[120-2415]

RECORDING OF ACOUSTIC WAVE IN GASEOUS MEDIUM WITH THIN-FILM PYROELECTRIC TRANSDUCERS

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 4, Jul-Aug 84
(manuscript received 31 Dec 82) pp 428-431

BELYAYEV, S. V., GORELIK, V. M., KON'KOV, K. A., MYZGIN, Ye. A.,
PLESHKOV, G. M., POL'SKIKH, E. D. and CHAYANOV, B. A., Scientific-
Research Institute of Organic Intermediate Products and Dyes

[Abstract] The feasibility of using thin pyroelectric films instead of thick ceramic ones for recording acoustic waves in air or other gaseous media is examined on the basis of theoretical relations and experimental data. The sensitivity of such a microphone is determined by the proportionality of its output voltage to the amplitude of temperature fluctuations and the proportionality of the latter to the acoustic pressure. Experiments were performed using a 0.7 μm thick pyroelectric film between 500 \AA thick upper and lower electrodes, on a glass substrate with 0.1-0.2 μm thick polymer coating. A circular hole at the center of the substrate allowed direct thermal and acoustic contact between the transducer and the ambient air on both sides. Measurements were made by the comparison method, using an MV-760 microphone with 2.8 mV/Pa sensitivity and a maximum 2 dB nonuniformity of the frequency characteristic over the 40 Hz - 20 kHz range as a reference. A series K284UN1 integrated-microcircuit amplifier with 1 Gohm input impedance was placed near the transducer and a ZDC-40 loudspeaker as a sound source was connected to a sine-wave voltage generator, feedback from the microphone to this generator ensuring a constant sound pressure of 1 Pa over the entire frequency range. Theoretical analysis and evaluation of data are based on calculation of heat transfer from air to transducer film. The differential equation of heat conduction was solved for this purpose, assuming a uniform distribution of heat sources in the acoustic near field (within distance $\Delta x < 0.1\lambda$ from the film surface, λ - wavelength of sound in air) and a sinusoidal temperature fluctuation in time. Jumpwise changes in coefficients (thermal conductivity and specific heat) at the air-film boundary made it necessary to solve that equation by the numerical method of finite differences. The results indicate no better sensitivity of thin films than thick ceramic ones, but that a thin-film transducer with 30 $\mu\text{V}/\text{Pa}$ sensitivity can acoustic waves at 1 kHz frequency. Figures 4; references: 3 Russian.
[120-2415]

SPACE PROCESSING OF ACOUSTIC SIGNALS IN PLANE-PARALLEL WAVEGUIDE

Moscow AKUSTICHESKIY ZHURNAL in Russian Vol 30, No 4, Jul-Aug 84
(manuscript received 10 May 82, after revision 11 Jan 83) pp 495-501

KALYUZHNYI, A. Ya., KRASNYY, L. G. and KRIZHANOVSKIY, V. V.

[Abstract] A two-dimensional antenna array in a vertical plane inside a horizontal waveguide is considered for space processing of acoustic signals from a source also inside that waveguide. Algorithms of processing are constructed on the basis of Hankel function asymptotics in the Fraunhofer region, assuming a δ -correlated interference. The optimum algorithm is found to have generally higher interference immunity than the algorithm for free space, both having the same interference immunity only in the special case of a linear horizontal antenna array. The amplitude-phase distribution in the antenna aperture and the transverse velocity profile are calculated, whereupon the dependence of the signal-to-interference ratio on the distance from source to antenna as well as the sensitivity of the processing algorithm to the error of distance reading are determined. Numerical calculations have been made for a linear array of 48 elements spaced uniformly 0.1λ apart inside a waveguide 10λ high (λ = wavelength of sound in the waveguide). The results reveal that nonconformance of processing algorithms with the modal structure of the signal field causes an appreciable lowering of their interference immunity and that the optimum algorithm with coherent summation of output voltages from partial channels matched to corresponding signal modes has a low stability against variation of a priori data on the source coordinates. With limited a priori data on the source coordinates and the waveguide properties, noncoherent summation of output voltage will raise the interference immunity of these algorithms. Figures 8; references: 3 Russian.
[120-2415]

UDC 621.372.011.711:534.86

SYSTEM OF PHASE-LOCK AUTOMATIC FREQUENCY CONTROL WITH ACOUSTOELECTRONIC CONVOLVER

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 10, Oct 84 (manuscript received 1 Nov 84) pp 89-90

TARASOV, V. M. and BRYGIN, S. I.

[Abstract] The feasibility of using an acoustoelectronic convolver with surface acoustic waves for phase-lock automatic frequency control is examined on the basis of the fundamental equation for the convolver output

signal $Y(t) = C_1 L + C_2 \int_{-1/2L}^{1/2L} \sin[\theta(t + \frac{z}{v}) - \hat{\theta}(t - \frac{z}{v})] dz$ where

($C_1 = 1/2e\mu(n_s E_{s0} + n_r E_{r0})$, $C_2 = 1/2e\mu(n_s E_{r0} + n_r E_{s0})$, e - charge of an electron, μ - mobility of charge carriers, E_{s0} and E_{r0} are amplitudes of two surface acoustic waves, n_s and n_r are amplitudes of the charge concentrations induced by the respective surface acoustic waves, L - length of nonlinear-interaction space, v - velocity of surface acoustic waves). When the phase error $\phi = \theta - \hat{\theta}$ is constant along the interaction space, this equation simplifies to $Y(t) = L(C_1 + C_2 \sin\phi)$. The nonlinear dynamics as well as theoretical conditions for stability over the $0-2\pi$ range of phase shift and for absolute instability having been established, pull-in and pull-out limits are determined for a first-order phase-lock control loop with an interdigital convolver. Figures 1; references: 1 Russian. [118-2415]

UDC 681.14.087.7

PSYCHOLOGICAL AND PHYSIOLOGICAL BASIS OF STEREOPHONIC EFFECT

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84
(manuscript received 16 May 83) pp 12-16

YEFIMOV, A. P.

[Abstract] The stereophonic effect is related to binaural perception and resolution of sound level differences and time delays, "front and back" as well as "left and right" hearing, threshold sensitivities, and "depth" of hearing. Development of stereophonic systems has stimulated extensive interest and research in both psychological and physiological aspects of this effect, involving not only the ears but also the head. Various models of hearing have been proposed, the most comprehensive one combining resonance characteristics and corresponding frequency analysis with correlation analysis. The latter implies an a priori given signal and interference functions or spectra. Another fundamental aspect of the stereophonic effect is the physical one. The physical mechanisms of detection, filtration, and localization of sound depend on its spectrum and degree of coherence as well as the noise content. The theory of the stereophonic effect covers both the listener and the performer. References: 16 Russian. [93-2415]

ANTENNAS AND PROPAGATION

UDC 621.372.826:621.396.96

INTERFERENCE IMMUNITY OF OPTICAL RADAR SYSTEM WITH PHASED ANTENNA ARRAY

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received, after revision, 30 Nov 83)
pp 22-27

ALISHEV, Ya. V. and YAMAYKIN, V. Ye.

[Abstract] A phased antenna array of an optical radar system with single-mode or phase-locked laser sources is analyzed for interference immunity. The array, specifically a cophasal one, is assumed to emit pulses of constant amplitude and duration, at some average carrier frequency and with a repetition period much longer than the pulse duration, a control device ensuring that every pulse begins at the same carrier phase. A major factor influencing the performance as well as the method of analysis is the relative magnitudes of coherence length and path difference, the latter characterizing the interference pattern of light beams and its effect on the antenna radiation pattern. Although a path difference much smaller than the coherence length permits assumption of a quasimonochromatic radiation, interference must be accounted for when the path difference is comparable with the coherence length. The directive gain and the probability of detection error are calculated accordingly, assuming Poisson distributions of "signal" photons with either vertical or horizontal polarization and of "noise" photons at the receiver input. Estimates indicate that reducing the error probability to below 10^{-5} is feasible by phasing the antenna of an optical radar system operating under normal conditions. Figures 3; references 8: 7 Russian, 1 Western (in Russian translation).
[118-2415]

COPHASAL HORIZONTAL WIDEBAND ARRAY ANTENNAS FOR TRANSMITTERS WITH ASYMMETRIC OUTPUT

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 14 Feb 84)
pp 52-55

BELOUSOV, S. P., KLIGER, G. A. and ESKIN, N. A.

[Abstract] Type SGDR cophasal horizontal wideband antennas for transmitters with asymmetric (single-stage) output are described, such antennas being preferable to SGD antennas operating with symmetric (push-pull) transmitters because of easier feeder matching and higher immunity to unfavorable environment. An antenna of this kind consists of rigid shunt vibrators and an asymmetric feeder channel. The latter is formed by symmetric overhead feeders, a symmetrizing device being available for operation with a single-stage transmitter. Two typical constructions are: one tower section with four tiers of vibrator groups and two tower sections with eight tiers of vibrator groups on each, with an adapter from symmetric to asymmetric feeder channel in each case. Various arrangements for power feed are possible, coaxial cables being most suitable for this purpose. The performance characteristics of these antennas have been measured with a 75-ohm or 120-ohm coaxial feeder cable, including both resistive and reactive impedance components as well as voltage standing-wave ratio over the 250-600 MHz frequency range and the field radiation pattern in the vertical plane within the major lobe. The voltage standing-wave ratio was found to remain high, within the 0.7-0.92 range over the entire frequency range. The major lobe was found to remain narrow, within 14-22°, widening with an increase of the phase shift between vibrator groups and with deviation of the wavelength in either direction from the nominal for which the antenna had been designed (76 cm). Design and performance calculations are based on the assumption of a uniform distribution of power over the antenna tiers. This is not exactly true in the case of noncophasal excitation of vibrators and a voltage standing-wave ratio lower than unity. Figures 7; references: 2 Russian. [98-2415]

ANTENNA WITH OUTBOARD EXCITER FOR 3.4-13.25 GHz FREQUENCY RANGE

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84
(manuscript received 15 Jul 83) pp 22-28

TIMOFEYeva, A. A., KOZLOVSKAYA, I. A. and KHLOPKOVA, Z. K.

[Abstract] A nonaxisymmetric antenna with outboard exciter and a circular aperture 1.1 m in diameter is now produced commercially in the USSR. This ANK-1.1 antenna is designed for the 3.4-13.25 GHz frequency range. Four

different rotatable exciters, sharply bent horns tilting 22° from the vertical, match frequency bands 4, 6, 8, 11 GHz wide respectively. The performance with each of the exciters has been evaluated theoretically and measured, including the frequency characteristics of gain, surface utilization factor, and standing-wave ratio under horizontal polarization and vertical polarization. The radiation patterns have been established and found to meet guarantees within and around the main lobe as well as within the side lobes in the far field. The antenna with any exciter has a stable and smooth nonoscillating frequency dependence of gain and surface utilization factor. With the 4 GHz exciter (diameter 70 mm) or with the 6 GHz exciter (diameter 43 mm) it has a small gain but a high interference immunity. With the 8 GHz exciter (diameter 32 mm) or with the 11 GHz exciter (diameter 24 mm) it has a radiation pattern with very weak side lobes in front and in back. Small size and weight make this antenna suitable as etalon for measuring the gain characteristics of large antennas. Figures 7; tables 1; references 5: 4 Russian, 1 Western.

[80-2415]

BROADCASTING; CONSUMER ELECTRONICS

UDC 621.316.72:681.325.3

CONVERTERS OF SUM/DIFFERENCE OF CODES TO FREQUENCY

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 27 Jul 83)
pp 54-56

SEDLITSKIY, G. L.

[Abstract] Converters of sum/difference of codes to frequency

$(\sum_{i=1}^P A_i - \sum_{j=P+1}^{P+Q} A_j) \rightarrow F$ are considered and the principle of building such con-

verters is explained. The basic device is a code-to-frequency converter, an extension of a discrete phase inverter into a digital synthesizer with summation of pulse sequences. A 6-bit converter built with series K155IYe8 integrated microcircuits is already available and several of them can be combined for a larger number of bits. The sum of any number of binary codes A_1, \dots, A_{P+Q} can then be converted to frequency by direct summation of the frequencies of corresponding pulse sequences. Because frequency is a non-negative quantity, the sum of codes corresponding to a frequency difference must be smaller than the sum of codes corresponding to a frequency sum. In the case of three codes, accordingly, $A_3 < A_1 + A_2$, where A_3 is a code corresponding to the subtrahend frequency. Several logic schemes are possible for realization of such converters. The frequency spectra of their output signals contain various features, however, which need to be further examined. Figures 6; references: 4 Russian.
[80-2415]

ANALYSIS OF SPECTRAL CHARACTERISTICS OF MULTILEVEL DIGITAL COMPUTING SYNTHESIZERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received 1 Dec 83) pp 66-68

SHISHOV, S. Ya. and YAMPURIN, N. P.

[Abstract] A digital computing synthesizer of multilevel signals is considered which consists of a digital phase storage, a code-to-function converter, a digital-to-analog converter, and a low-pass filter in series. The code K of a linearly increasing phase angle is stored at frequency f_0 for synthesis of frequency $f_s = Kf_0/2R$ (R - storage capacity) and then converted to a symmetric triangular or sinusoidal function, whereupon the filter extracts the signal with frequency f_s from the multilevel signal $S(t)$. The spectral characteristics of such a synthesizer are analyzed upon introduction of the parameter $NB = 2R/N_\phi$ (N_ϕ - number of phase quantization levels), which characterizes the converter output resulting from multiplication of the storage content by $1, 2, 3, \dots$. The synthesizer can operate in two modes, depending on whether $NB \geq K$ or $NB < K$, respectively. The ratio P of useful signal to largest spurious component within the $0-f_s$ range is calculated as a function of the code length for various numbers of amplitude quantization levels N_A . The results indicate that for a sinusoidal signal this ratio is principally determined by the number of amplitude quantization levels, namely $P = 4 + 6\log_2 N_A \pm 2$ dB. The results are applicable to such synthesizers built with series K533 logic microcircuits. Figures 2; references: 4 Russian. [118-2415]

EVALUATION OF INFLUENCE OF QUANTIZATION PRECISION ON EFFECTIVENESS OF SIGNAL DISCRIMINATION IN THE PRESENCE OF CORRELATION NOISE

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received, after revision, 3 Apr 84)
pp 68-70

ROG, A. I. and SIROTA, A. A.

[Abstract] The efficiency of signal discrimination from correlated noise in digital processing is estimated, with the precision of time discretization and level quantization taken into account. Calculations are made for the sufficiently general case of an array of signals $S_i(t) = m_i(t) + n(t)$ consisting of a deterministic component $m(t)$ each and a Gaussian noise $n(t)$ with a correlation function $\sigma^2 R(\tau)$ ($i = \overline{1, L}$). Calculations yield a general relation for the increment of probability error caused by quantization. As

a special case is considered a biorthogonal array of signals

$$\{m_i(t) = \sum_{i=0}^{1/2L} A_m \cos(2\pi i t/T)\}^{1/2L}. \text{ Figures 2; references 7: 6 Russian,}$$

1 Western (in Russian translation).
[118-2415]

UDC 621.391.26

ADAPTIVE DETECTION OF NOISE SIGNAL ACCORDING TO NEUMANN-PEARSON CRITERION

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received, after revision, 26 Mar 84)
pp 71-73

PADIRYAKOV, Yu. A.

[Abstract] Optimum detection according to the Neumann-Pearson criterion is considered in the case of a random Gaussian noise signal, stationary during measurement, and a stationary random Gaussian background interference. Detection is based on two samples, their statistics characterized by estimates of their spectral densities, it being a priori known that sample A from the signal channel is either the sum of signal and interference (hypothesis H_1) or interference alone (hypothesis H_0) and sample B from the reference interference channel is an interference with the same spectral density as that of the interference in sample A for both hypotheses. Signal and interference are in each sample pair-wise independent; their spectra are a priori unknown. The probability of correct detection is maximized on the average, first in the $2N$ -dimensional space of signal spectral density and interference spectral density readings, by fixing the probability of false alarm at each point so as to stabilize it at a constant level against variation of the interference spectral density. Deterministic decision rules are established, with the resolving function given and equal to 1 or 0. The algorithm is then reduced to equivalent detection in the N -dimensional space of the ratio of sample A readings to sample B readings. Synthesis and analysis of this Neumann-Pearson algorithm for a mixture of wideband noise signal and wideband interference, with Taylor series expansion of the correspondingly defined signal-to-interference ratio as a function of the ratio of sample A readings to sample B readings in the vicinity of value 1 of the latter ratio, reveal that the interference immunity of this algorithm in this case is almost as high (not less than 0.15 dB) than that of a heuristic algorithm (Yu. A. Padiyakov and Yu. L. Mazor, RADIOELEKTRONIKA Vol 25, No 4, 1982 pp 96-98) within a 0.5 dB confidence interval with a 0.95 confidence coefficient. The heuristic algorithm is much more economical, in hardware or in software, for noise signals with intricate spectra under conditions of a priori parametric indeterminacy. Tables 1; references 5: 4 Russian, 1 Western (in Russian translation).
[118-2415]

TRANSIENT PROCESSES IN TUNED AMPLIFIER DURING PHASE-SHIFT KEYING WITH SMOOTH PHASE VARIATION

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 84 (manuscript received 17 May 83)
pp 50-53

KAMALYAYEV, N. A.

[Abstract] Phase telegraphy with 0-180° keying combines high interference immunity with vulnerability to overvoltages, protection against the latter by means of decremental attenuation resulting in some loss efficiency. For an optimum design of such a system, which contains a tuned amplifier, the transient processes affecting the amplitude of the output signal envelope are analyzed for various smooth laws of phase variation on the input side. A comparison of varying the phase as linear, second-degree parabolic, or third-degree parabolic function of time, and calculation of the corresponding envelopes of instantaneous frequency deviation for a single-stage amplifier indicate that in each case the variation of output signal amplitude increases with increasing instantaneous relative frequency deviation. The transient periods in each case shorter than in the case of jumpwise or stepwise phase variation, which makes smooth phase variation preferable. Figures 4; references 4: 3 Russian, 1 Western (Russian translation from German).
[128-2415]

APPARATUS FOR CHECKING CONNECTION LINES IN URBAN TELEPHONE NETWORKS

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 16 Feb 83)
pp 29-33

KOSHELEV, V. K., SLAVIN, Z. M., MOL'VIDSKIY, R. K. and BORODYANSKIY, I. I.

[Abstract] New equipment has been developed by the Central Design Office at the USSR Ministry of Communication for large urban telephone networks, namely AKKS for monitoring communication service quality and APKU for checking connection lines. The latter comes in two versions, APKU-Sh for 10-step automatic telephone systems and APKU-K for crossbar telephone offices. The equipment measures attenuation and noise in KRR-M and KA'IA transmission channels coupled to multiplex trunk-line relays. Data are fed to a microprocessor array through busbars and control modules, all built with high degree of large-scale integration using series K580 microcircuit chips. Checking can be done by manual or automatic control. The algorithm of data processing and evaluation has been programmed for any applicable computer, with teletype readout. The equipment requires a 60_{-2}^{+6} V d.c. power supply and operates normally at temperatures from +5 to +40°C. Its prototype has been successfully tested in 1983 in the Moscow Telephone System and its commercial production has already begun. Figures 3; references: 4 Russian.
[80-2415]

AUTOMATION OF SERVICIBILITY OF RADIO-RELAY STATION EQUIPMENT

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 10 Oct 83)
pp 11-14

UR'YEV, A. G., NISHIN, Ye. I. and ITKIS, G. Ye.

[Abstract] Automation of the serviceability of radio-relay station equipment must ensure central gathering and primary processing of reliable instrument readings with subsequent display on the control panel, detection and recording of failures soon enough, advance enough warning based on analysis of deterioration symptoms, and correct remote measurement of equipment performance parameters. Such an inspection will minimize transmission losses while, at the same time, reducing nonproductive time and labor spent on documentation and measurement. A multichannel automated inspection system for this purpose should operate by a parallel rather than sequential procedure, considering the large number of check points. Digital data processing is more expedient in this case than analog method and, therefore, analog-to-digital converters are required, but the relatively low precision needed here allows the use of simplest and least costly devices. Special "normal", "above limit" and "below limit" test signals provide means of self-inspection, to which must be added adequate interference immunization, stabilization, and standby power supply. the mode of operation differs somewhat depending on whether large or small quantities of radio relay equipment are involved, a microcomputer becoming necessary or a microprocessor with "hard logic" being sufficient respectively. Use of a microcomputer permits overall refinement and expansion of the inspection system, in terms of scope and capacity, while it minimizes though not completely eliminates dependence on subjective judgment. Introduction of such an inspection system should begin with continuous data gathering from equipment already installed, to be followed by installation of microcomputers with the most advanced integrated microcircuitry.

Figures 2.

[80-2415]

SYSTEM OF LIGHT PROTECTION OF ANTENNA-MAST STRUCTURES OF RADIO RELAY LINES

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 30 Jun 84)
pp 14-15

LARIN, V. Ye., MARTYNOV, Ye. V. and TISHCHENKO, M. P.

[Abstract] A light guard for equipment of radio relay links in airports has been developed which draws not more than 100 W from a 24 V d.c. source. It provides automatic local or remote switching on and switching off, local or remote failure monitoring of 50% installed lighting capacity, and continuous

or intermittent glow. Steady red signal lights are used in bright areas and flashing white signal lights are used in dark areas. The lights are controlled by a device consisting of an automatic photocell circuit with input voltage stabilizer, one normally-open transistor switch, two normally-closed transistor switches, a logic, an inspection and alarm set, a matching module with bay, a diode bank, and a power supply. Photocell and logic are off during daylight. As the sunlight drops below a preset level, a constant-current or pulse-current control signal flows from the photocell to the logic, the latter then sending a constant or pulse current through the diode bank to the output terminals. As the sunlight rises above a preset level, both photocell and logic return to their off state. The changeover from one state to another is effected by appropriate operation of the switches. The photocell circuit is a modified ESP-90-1 device which, in addition to the signal tube controlled by a photoresistor and a stabilatron, also contains a white or red lens with focusing cartridge in a polyethylene case. Lamps hooked up to one circuit are spaced along different diagonals on antenna tower tiers so as to ensure a full-circle visibility in case the other circuit fails. Figures 2; references: 4 Russian.
[80-2415]

UDC 654.195.2

HOW TO GROW ACCUSTOMED TO WIRE BROADCASTING?

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 15 Sep 83)
pp 49-51

SHAMSHIN, I. A.

[Abstract] The problem of growing accustomed to wire radio broadcasting is a timely one, inasmuch as this mode of broadcasting has already become quite widespread in the Soviet Union. An indicator of its scope are the 2 million kilometers of overhead and underground lines used for this purpose, with just as many kilometers of house wiring in 97% of all populated areas for 85% of all families. At the same time, urban telephone networks are expanding at such a high rate that a tremendous increase of density is expected by the year 2000. Rural telephone networks are expanding more slowly, but integration of telephone and broadcasting is imminent here as well as in urban districts. The problem of adaptation to this trend has several aspects, compatibility of the different transmission modes and adequate conductor capacity as well as adequate power supply being the foremost ones. A preliminary requirement is that a radio terminal be available wherever a telephone set has been installed. The next requirement is appropriate dialing and switching equipment. Accordingly, laboratory and field work is underway on a changeover to 3-program broadcasting over telephone wires. Pertinent research and development are conducted in the Central Design Office as well as in the Moscow Urban Radio Rediffusion System and in the Moscow Urban Telephone System. References: 13 Russian.
[98-2415]

MODERN STEREOPHONIC STUDIO EQUIPMENT

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 6 Apr 83)
pp 26-30

RUZANOV, I. V., NIKONOV, A. V. and CHURILIN, V. V.

[Abstract] Since the late nineteen seventies three makes of third-generation stereophonic studio equipment have been available: "Perspektiva" (produced in the Soviet Union), FIT-IS (produced in Hungary), ESS-ESQ (produced in Czechoslovakia), with some components purchased from AEF-Telefunken (FRG), Studer (FRG), and Nive (England). The equipment consists of stereophonic as well as monophonic microphones, magnetic sound recorders, dictaphones, sound track recording-dubbing-editing-broadcasting monitors, central control panels, automatic sound level regulators including level limiters, speech compressors, and threshold noise suppressors, also reverberators and measuring-inspection instruments. Subsequent innovations in stereophonic studio equipment involve introduction of large-scale integrated and large-scale hybrid integrated circuits for changeover to digital signal encoding, processing, and transmission. Figures 4; tables 1; references 9: 8 Russian, 1 Hungarian (in Russian translation).
[93-2415]

"HORIZON Ts-257"

Moscow RADIO in Russian No 11, Nov 84 pp 24-26

ROGINKIN, V. and SUKHODOL'SKIY, V., Minsk

[Abstract] Pulsed power supply for "HORIZON-257" television application is described. The 50-Hz line voltage is converted to rectangular pulses with a 20..30kHz repetition rate, and is subsequently rectified. The input voltages are stabilized by varying the pulse duration and the pulse repetition rate. The power supply consists of two functionally independent units: the supply module and the filter plate. The fundamental engineering characteristics of the units are included, and the supply module circuit is shown in a diagram. The circuit contains a rectifier of the line voltage, the triggering cascade, stabilization and blocking units, a converter, four half-wave rectifiers of the output voltages, and a voltage stabilizer for 12 V. The filter plate contains elements of the rejection filter, current limiting resistor and a device for automatic demagnetization of the picture tube mask. Figures 3; tables 1.
[126-12755]

OUTLOOK FOR DEVELOPMENT OF CABLES FOR RURAL TELEPHONE NETWORKS

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 p 10

[Abstract] A report on "Cables for rural telephone networks and wire broadcasting: state of art and outlook for development" was presented in March 1984 by the Scientific Research Institute of Communication, Leningrad Department, to the Scientific and Technical Council at the USSR Ministry of Communication. It dealt with problems of providing a public telephone system as well as in-plant and dispatcher service, also wire broadcasting, for Kolkhozes and Sovkhozes. Currently in use are TPPZ hydrophobic-filler cables with 10-100 pair bundles and hydrophobic-filler or polyvinyl-covered single-pair wire broadcasting cables. Additional cables already recommended for this purpose are TSPZP hydrophobic-filler 3-4 pair cables, TPPZ cables with 0.32-0.8-0.5-0.7 mm copper conductors, PRPPM 2x9 single-pair cables for remote subscribers, and KSPZP(B) 1x4x0.9 cables. Still needed for this application are RMPEEP 2x1.2, PBPZEP 2x1.2, RMPZEPB 2x1.2 single-pair cables, and KSPZP(B) single-quads standard or with built-in support strand. [80-2415]

TO INCREASE THE EFFICIENCY OF UTILIZATION OF TRUNKS

Moscow VESTNIK SVYAZI in Russian No 11, Sep 84 pp 29-30

YEFIMOV, A. P., Candidate of Technical Sciences, Associate professor (Dotsent), All-Union Correspondence "Electrical-Engineering Institute of Communications (VZEIS); BAGLAROV, I. A., Candidate of Technical Sciences, Associate professor (Dotsent), Georgian Polytechnical Institute; and YERIMASHVILI, V. A., Exchange Chief of the Republic Radiofication Center under the Georgian SSR Ministry of Communications

[Abstract] Symmetrical pairs of the city telephone network wires are now mostly used in wire broadcasting systems as the connecting lines. The central radio station is connected to the amplifier stations by 4 to 8 lines. Larger systems use a greater number of lines for certain other applications. The efficiency of utilizing the connecting lines is not great, because only audio frequency can be used. The Tbilisi Broadcasting Rediffusion Network and the Department of Radio Broadcasting and Television of the All-Union Correspondence Electrical-Engineering Institute of Communications conducted computer-aided theoretical and experimental studies in order to establish the feasibility of increasing the efficiency of using the trunks of the municipal radio lines. Measurements were conducted on several types of cables of different diameters with different numbers of core wires. The measurement results did not completely agree with the theoretical. Various possibilities of increasing the efficiency were tested with standard equipment for frequency and time sharing possibilities, including the application of pulse-code modulation. After conducting an engineering and economic analysis, it was determined that for relatively short lines no advantages would be obtained. Consequently, a simpler approach was selected of using

the TPV 74 and 120KHz carrier-frequency system for transmitting the broadcast signals with the available equipment. Various aspects of engineering problems were examined without arriving at a satisfactory solution, and a further study was suggested. Tables 1.
[122-12755]

CIRCUITS AND SYSTEMS

UDC 621.39.049.77

NEW LARGE-SCALE CIRCUIT INTEGRATION FOR COMMUNICATION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 28 Dec 83)
pp 35-36

BOLDYREV, G. A., ZAKHAROV, V. P. and PETRENKO, N. V.

[Abstract] A new LSI chip K145IK1905 has been developed jointly by the Central Scientific-Research Institute of Communications in Leningrad and the Moscow Institute of Power Engineering for reception, storage and readout of data coming in a decade-pulse code. It is built with low-threshold p-channel MOS devices, which allows high-density packing and low-cost manufacture. One chip can be programmed for two 7-digit telephone numbers, one of them stored in a memory for redialing. The memory can be built up to 32 7-digit numbers with a K145IR2 external 1024x1-bit memory. The chip can be installed in telephone receiver sets and in automatic exchange offices. Figures 1.
[80-2415]

UDC 621.372.542.25:621.395.345

MONOLITHIC QUARTZ FILTERS FOR EXTRACTION OF CLOCK FREQUENCY IN DIGITAL COMMUNICATION SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 18 Apr 83)
pp 15-17

PETRYAKOV, S. V. and KACHAL'NIKOV, Yu. V.

[Abstract] Monolithic quartz filters are considered for extraction of clock frequencies within the 1-150 MHz range in secondary and tertiary digital pulse-code modulation (PCM) communication systems, their main features being high stability of the phase-frequency characteristic and consequent high interference immunity. In order not to degrade the performance of an PCM system beyond the lowest acceptable level, insertion of such a filter into the network must not shift the signal phase by more than $\pm 10^\circ$ at

the clock frequency. Such a filter must also not lengthen the locking time, and correspondingly the holding time in case of signal loss, beyond 1000 clock periods so that the bandwidth of the filter must be at least 0.1% of the clock frequency. Ways of reconciling these requirements with selectivity are examined, taking into account accuracy of center-frequency setting and frequency drift over a life of 10 years as well as frequency drift caused by worst-case temperature swings from -20°C to $+60^{\circ}\text{C}$. A doubly tuned monolithic filter with maximally flat attenuation characteristic is considered, a triply tuned one exceeding the allowable signal phase shift to $\pm 15^{\circ}$. Such filters are now used for two standard clock frequencies (8.448 and 34.368 MHz), but their structure and design can be modified for lower clock frequencies (1.024 and 2.048 MHz in IKM-15,30 systems, respectively) or higher clock frequencies (139.264 MHz in IKM-1920 system). Figures 8; references 6: 5 Russian, 1 Western (in Russian translation). [98-2415]

UDC 621.372.544.029.6

TWO-MODE DIELECTRIC-WAVEGUIDE FILTERS WITH ELLIPTICAL AMPLITUDE-FREQUENCY CHARACTERISTIC

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 5 Dec 83) pp 56-59

BERGER, M. N., ISHCHUK, A. A., KAPILEVICH, B. Yu. and TRUBEKHIN, Ye. R.

[Abstract] Filters with elliptical amplitude-frequency characteristics and correspondingly high selectivity are most desirable for multiplexing of microwave radio relay channels, with additional couplings between filter sections provided for this end. Such a filter can be built using multiresonator dielectric waveguides with coupling mutually orthogonal two modes beyond cutoff. In one variant a dielectric insert is placed inside a square waveguide symmetrically between entrance and exit sections, as well as with respect to one diagonal of the corresponding square channel cross section. Coupling of oscillation modes is ensured by a tuning screw as close as possible to the insert, and collinear with a diagonal of the corresponding square channel cross section. A four-cavity filter has been designed for the 2.08 ± 0.082 GHz frequency band with a 1.25 voltage standing-wave ratio and guaranteed 30 dB attenuation in the stop band, these Zolotarev-Cauer characteristics being most closely approximated by a T05-10 Chebyshev prototype filter. Filters were also built and tested for the 11.350 ± 0.0575 GHz and 11.228 ± 0.02807 GHz bands, all found to have elliptical amplitude-frequency characteristics. Tuning of these filters requires adjustment of the coupling, successively, first and second, third and fourth, second and third, and first and fourth modes of the two orthogonal pairs. Figures 5; tables 1; references 7: 5 Russian, 2 Western (both in Russian translation). [98-2415]

NORMALIZING CHARACTERISTICS OF MULTICHANNEL LIMITERS FOR PHASE-CODE-MODULATED SIGNALS

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received 5 Oct 83) pp 27-30

LESHCHINSKIY, M. M. and LEZIN, V. Yu.

[Abstract] The normalizing characteristics of 2-channel and 4-channel limiters for phase-code-modulated signals are analyzed on the basis of numerical simulation on a digital computer and experimental data, such limiters being installed between the analog-to-digital converter and the compressing matched filter before a modular detector with storage for processing composite signals with a wide dynamic range. The weak-signal loss which characterizes the performance is calculated first for the case of a weak signal appearing alone in an independent mixture with Gaussian noise. It is assumed that one readout corresponds to an elementary pulse, that the number of pulses equivalent to the code length is $N \gg 1$, and that the relative level of side lobes after comparison has been reduced to $1/\sqrt{N} \ll 1$. A weak signal overlapping a strong one is considered next, with the probability of coincidence of their nonzero levels after the transient period in the resolving filter equal to the inverse of the number of channels, and assuming a complete suppression of the weak signal in the case of such a coincidence. Calculations are made and results are shown for an MO-2 2-channel limiter with a signal in the Barker code ($N = 13$) and for an MO-4 4-channel limiter with a signal in the Huffman code ($N = 63$). Figures 2; references 4: 3 Russian, 1 Western (in Russian translation).
[118-2415]

ESTIMATION OF SPECTRUM PARAMETERS AND DISCRIMINATION OF RANDOM SIGNALS BY MEANS OF ACOUSTOOPTIC SPECTRUM ANALYZER IN PRESENCE OF INTERNAL NOISE AND EXTERNAL INTERFERENCE

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received, after revision, 27 Mar 84)
pp 30-36

NAKHEMANSON, G. S.

[Abstract] An acoustooptic spectrum analyzer is considered for estimating the statistical spectrum characteristics of random signals and their discrimination on this basis, such an analyzer consisting of an ultrasonic light modulator in the input stage and an array of charge-coupled devices acting as optoelectronic converters in the photoreceiver stage. The performance of such an analyzer is evaluated in terms of correct or

or false signal discrimination, considering that the probabilities of correct and false discrimination depend on the signal-to-noise and signal-to-interference ratios as well as on the integration time interval in the photoreceivers and on the quantization step of their output signals. An additive mixture of a normal random signal and a normal stationary interference with given correlation functions and zero mean values is assumed to enter the ultrasonic light modulator operating in the Bragg diffraction mode. The normalized bias and dispersion of spectrum width estimates are calculated as functions of the normalized photoreceiver threshold, for a random signal with a rectangular spectrum of given amplitude five times wider than the frequency resolution of the analyzer when such a signal appears submerged in external interference and internal noise each with given spectral densities. The probabilities of correct and false discrimination are calculated as functions of the signal-to-interference ratio, of the ultrasound storage time to ultrasound aperture passage time ratio, and of the number of output quantization levels. The results indicate ways in which the optoelectronic system can be optimized for maximum accuracy of estimates and maximum probability of correct discrimination. Figures 1; tables 1; references 5: 4 Russian, 1 Western.

[118-2415]

UDC 621.395.5

REALIZATION OF MULTISTAGE STRUCTURE FOR 60-CHANNEL TRANSMULTIPLEXER

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received, after completion, 30 Aug 82) pp 41-44

BRUNCHENKO, A. V.

[Abstract] A multistage structure has been synthesized for a 60-channel digital transmultiplexer as a coupling between systems with time division and frequency division of channels, respectively. It contains a time-division to frequency-division (digital-to-analog) converter and a frequency-division to time-division (analog-to-digital) converter with corresponding arrays of complex-number multipliers with $\pm j^n$, $e^{\pm j3\pi n/4}$ coefficients and product adders, as well as arrays of digital filters with $H_1, H_1', \dots, H_7', H_2'', \dots, H_7''$ transfer characteristics and arrays of read-only memories. Use of identical digital filters simplifies the addition of products and yields a structure more efficient than the conventional one based on discrete Fourier transformation with a comparable degree of hardware complexity and operating speed, although not as many multiplications per second per channel can be performed in it. The H_1 -filters should be recursive, seventh-order ones being adequate for 11 multiplications with a discretization frequency of 8 kHz. The H_2, \dots, H_7 filters can be nonrecursive, fifteenth-order ones being adequate for 4 multiplications with discretization frequencies of 8-256 kHz. The H_1', \dots, H_7' filters act as interpolators, their discretization frequency being doubled from input to output. The H_2'', \dots, H_7'' filters act as demodulators, their discretization frequency being halved from input to output. An analysis of the complex-multiplication and addition process,

with registers occupying 90% of the space, indicates that a technically and economically optimum transmultiplexer structure will be attained with special-purpose large-scale integration, CMOS technology being particularly suitable for this application. Figures 5; references 4: 1 Russian, 3 Western.
[80-2415]

MULTIFUNCTIONAL INDICATOR

Moscow RADIO in Russian No 11, Nov 84 pp 38-40

LUK'YANOV, D.

[Abstract] Luminescent scale indicators for displaying analog values in the form of illuminated horizontal or vertical lines have found very wide application; they have no inertia, convenient read-out of information and the possibility of orienting several indicators in parallel. Special integrated microcircuits are manufactured for converting the input voltage into the analog-position code. There are scale indicators available with a built-in control, for example: IVLSHU1/2. They are used with consumer equipment as various tuning indicators, indicators of output power, low-frequency signal indicators, etc. Unfortunately, special indicator devices for these purposes are not readily available, and they also require various scale configurations. These problems, including provisions for incorporating various scale configurations in a single instrument, can be easily solved with the described instrument. This instrument employs a vacuum luminescent multi-digit indicator, but special scale and matrix indicators can also be used. In contrast to the devices using linear gas-discharge tubes, the device described needs less power, is more accurate and functions well even after long use. Basically, the indicator consists of a sweep generator, a function digital-to-analog converter controlling the length of the line glow as a function of the input signal voltage, and a comparator. A two-channel model of the device consists of a printed board unit containing all the elements. The unit requires no tuning. It is powered by two sources: +12 V $\pm 10\%$ and a -6...12 V, with power consumption of 55 and 5 mA, respectively. Figures 2; tables 1.
[126-12755]

COMMUNICATIONS

UDC 621.39

DIGITAL INFORMATION TRANSMISSION-PROBLEMS AND TENDENCIES OF DEVELOPMENT

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 84 (manuscript received 19 Jan 84)
pp 1-8

SHVARTSMAN, V. O.

[Abstract] The basic digital modes of communication in the order of their introduction and existence are: telegraph, data transmission, text and graphics transmission, electronic postal service, all making use of telephone lines. Hookup of the television receiver screen for visual display constitutes the latest development. The main problems throughout are reduction of manual labor by its replacement with a computer or microcomputers and microprocessors, and by the attendant improvement of computer performance in terms of capabilities and speed. The underlying goal is maximum efficiency and cost effectiveness. The most prominent systems now in operation worldwide (USA, Western Europe, Japan, USSR) are "Teletex", "Telefax", "Datafax" for use on a subscription basis and "Burofax" for use by communication enterprises on a lease basis. An interesting new development is the "Telautograph" system for simultaneous transmission of speech and manuscript over telephone lines. Projection into the future indicates a following sequence of development: 1) Gradual conversion of the public telegraph network to facsimile transmission and electronic postal service, with eventual integration of both into a public communication system analogous to "Burofax"; 2) Gradual conversion of the subscriber telegraph systems to "Teletex" and integration of the latter with a data transmission system; 3) Eventual combining of "Burofax" and "Teletex"- "Data Transmission" into an integrated-service digital network and incorporation of the latter into the primary communication network; 4) Transmission of all data, analog and digital, digitally over the integrated-service digital network equipped with universal terminals in the final stage. Figures 1; tables 1; references 16: 15 Russian, 1 Western.
[128-2415]

TECHNICAL AND ECONOMIC CHARACTERISTICS OF MULTIWIRE COAXIAL DEEPLY-COOLED CABLES.

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12, Dec 84 (manuscript received 18 Oct 83) pp 20-26

FEDIN, V. T., candidate of technical sciences, docent; and GONCHAROV, V. M., engineer, Belorussian Order of the Red Banner of Labor Polytechnical Institute

[Abstract] Technical-and-economic indices of cryogenic lines which are cooled to superconducting temperatures are not sufficiently high. One way for improvements consists of using inexpensive and technologically suitable superconducting materials, such as lead, and assuring maximum utilization of their current carrying capacity. Using lead in a two-tube coaxial system produces no positive economic effects. Theoretical studies were conducted which indicated that the current density of the transmitted current can be increased above critical of the density vector of the induced currents was in opposition to the transmitted current. It was concluded that the magnetic field of external sources can be oriented so that the critical currents of the superconductors are increased compared to the currents when the external magnetic field is not present. The essence of the method for increasing the transmitted superconducting current consists of aligning the transmitted and induced currents in a different direction in the same zone, or providing antiparallel orientation of the magnetic field intensity vectors of the transmitted current and of the external source. It was also concluded that using multitubular coaxial cryogenic lines with lead cores at relatively low nominal voltages would reduce outlays by factors of 2 or 3, compared to the two-tube coaxial lines made of lead, niobium and niobium stannite. Presented by the Kafedra (Chair) of Electrical Systems. Figures 4; references: 6 Russian.

[123-12755]

RELAYS WITH HERMETICALLY SEALED MEMORY CONTACTS

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 28 Mar 84) pp 37-41

RABKIN, L. I., DRACHEV, V. A., PEREKHODNIK, I. G. and LITOVKIN, I. A.

[Abstract] Relays with hermetically sealed memory reed-contacts and magnetic interlocking (gezakonovyye rele) are the latest improved version of relays with plain hermetically sealed contacts for quasi-electronic automatic telephone offices. Dropout of such a relay can be effected either by demagnetization of both contact pairs or by magnetization reversal

in one of them, the second method being preferable. The contact-reed pairs are each enclosed in a hermetic bulb, with coils wrapped around them for producing the magnetic field. All are mounted inside a housing, split into two compartments, if the coils are connected for two switching operations. The relays have been designed to tight dimensional and performance specifications, a major requirement being avoidance of premature cutout. This is ensured by operating the relay at a point on the force-distance characteristic within the range where the dropout time is determined by duration of the control pulse and that duration does not exceed the maximum possible relay actuation time. In relays requiring three coils for magnetic control, one of these coils is usually replaced with a permanent magnet. Altogether five models of such "Gezakov" relays are produced accordingly, in two sizes ($14 \times 50 \times 13 \text{ mm}^3$ and $26 \times 50 \times 13 \text{ mm}^3$) for three nominal voltages (12-24-60 V d.c.), without or with permanent magnet, with 1-2 closing contacts and with 0-2 opening contacts. Figures 7; tables 1; references: 8 Russian. [80-2415]

UDC 621.391:621.376.43

INTERFERENCE IMMUNITY OF COHERENT PHASE-KEYED-SIGNAL DEMODULATOR WITH OPTIMUM CLOCK SYNCHRONIZER AND IDEAL DETECTOR

Kiev IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 10, Oct 84 (manuscript received 20 Dec 83) pp 80-82

RASKIN, V. K.

[Abstract] An integrally receiving coherent demodulator of phase-keyed signals is considered with an optimum clock synchronizer and ideal detector. Although an ideal detector is not practically realizable, an analysis of such a demodulator reveals the effect of a finite number of readouts (channels) on its interference immunity. Considering that desynchronization is equivalent to a decrease of the signal-to-noise ratio at the resolver input and that optimum clock synchronization is one which leaves only uniform desynchronization over a readout-time interval, the conditional error probability and then the absolute (average) error probability are calculated for the worst case: reception of a single phase-keyed signal. The results indicate that limiting the number of synchronizer channels to $n = 10, 5, 3$ will reduce the interference immunity of reception by 0.64, 1, 3 dB, respectively. Figures 1; references 3: 2 Russian, 1 Western (in Russian translation). [118-2415]

TESTING MULTICHANNEL MODULATOR-DEMODULATOR IN DECA-METRIC-WAVE RADIO CHANNELS

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 84 (manuscript received 19 Oct 81)
pp 45-47

VENSKAUSKAS, K. K., DMITRIYEV, V. I., YELAGIN, A. V. and KROPACHEV, D. A.

[Abstract] A multichannel 2400 bit/s modulator-demodulator for use in decametric-wave radio channels for land, sea, and air weather or other communication services was tested from December 1979 to February 1980 between the Moscow oblast radio center and a ship on a Baltic Sea - Carribean Sea - Gulf of Mexico - Baltic Sea round trip, with the ship-to-station distance varying over a 2,500-13,000 km range. An audio group signal was sent over a telephone to the ship's "Brig" transmitter operating with a peak power of 2.5 kW into a wideband antenna with circular radiation pattern. Signals were returned to a "Shtil'" radio receiver without diversity operating in the Class A7J mode from a BS-2 antenna. The modem has 12 subchannels, 2 of them for service or standby communication and a 120 bit/s operational phase keying decoder in each. The measuring equipment consisted of an ID-010 generator of a 511 long binary pseudorandom sequence as an information source and a DIS test-signal generator at the transmitter end, an "Elektronika-100" minicomputer with a 4 kilobit memory and processor, as well as an oscillator, an analog-to-digital converter, a direct-access interface to memory, interface to tape or card punch, and interface to oscillograph through a digital-to-analog converter at the receiver end. Primary statistical processing of the data has yielded results indicating a bimodal bunching of errors and a bimodal distribution of intererror intervals, this bimodality being more pronounced in short communication routes. With increasing distance, on the other hand, the probability increases of independent errors because of a smaller signal-to-noise ratio and despite common fadeouts. The correlation between errors in different modem subchannels and their time distribution indicate a strong dependence between 20,40,..., 10,20,30,..., or 5,10,15,... elements in the error stream at 2400, 1200, 600 bit/s transmission rates, respectively. The results of this experimental study will be useful for most efficient application of various codes in radar systems. Figures 5; tables 3; references: 6 Russian.
[128-2415]

SUPPRESSION OF PULSE INTERFERENCE BY BLANKING FOR GROUP TRANSMISSION OF BINARY CODE

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 84 (manuscript received 10 May 83)
pp 48-49

VERSHININ, V. A. and LANDO, V. S.

[Abstract] Group transmission of binary data, namely simultaneous transmission of N elementary signals based on orthogonal functions, requires suppression of pulse interference. Signal blanking at the demodulator input is the most effective method of achieving this. As the duration of an interference pulse approaches the duration of an elementary signal, the probability of error becomes lower in group transmission than in sequential transmission. The advantage of group transmission increases further as the interference level decreases, which is readily demonstrated for the case of interference in the form of normal noise. There are further advantages of using Walsh functions rather than harmonic functions as orthogonal functions for group transmission. These advantages include foremost a uniform time distribution of energy with resulting higher inherent immunity to pulse interference and, furthermore, the feasibility of reducing the size of the modulator-demodulator while increasing its reliability by constructing it with digital integrated circuits. Figures 2; references 10: 9 Russian, 1 Western (in Russian translation).

[128-2415]

INTERFERENCE IMMUNITY OF BINARY SIGNALS IN MARKOV CHANNEL WITH FADING

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received, after revision, 14 Mar 84)
pp 78-80

BORTNIKOV, V. V.

[Abstract] The interference immunity of quasi-coherent receivers of discrete signals in stochastic communication or control channels is evaluated for one of the worst cases, namely a symmetric binary channel with exponentially correlated overall Rayleigh fadeout. A narrow-band input signal entering the receiver over a given time interval together with noise is assumed to be an array of continuous random Markov processes. The probability of detection error is estimated by analysis of the appropriate decision rule for binary signals. Because continuous Markov processes are normal random ones, in a stationary channel with Rayleigh fadeout they have a normal joint a posteriori probability density and equal dispersions. The corresponding detection algorithm is applicable to phase telegraphy with a local generator, two

ENCODING AND DECODING OF STEREOPHONIC SIGNALS IN SYSTEM WITH POLAR MODULATION

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 16 May 83)
pp 21-25

ZHMURIN, P. M.

[Abstract] The concept of a complex stereophonic signal is defined mathematically relative to modulation of the transmitter carrier signal in stereophonic radio broadcasting systems. So far the switching method of shaping such a signal is the most effective one, the input of an electronic switch being connected alternately to the outputs of two amplifiers of low-frequency signals. A polar-modulated oscillation appears at the output of the switch. Subsequent conversion of a polar-modulated oscillation to a complex stereophonic signal can be effected by means of two instrument modulators, MOD-12 and MOD-13, with a subcarrier suppressor network containing a thermostatically stabilized high-Q tank circuit. A better way is to use MOD-15 and MOD-16 modulators with high-precision RC-networks instead of a subcarrier suppressor so as to avoid errors and distortions caused by inaccurate tuning of the tank circuit and instability of the resonance frequency, followed further by a corrective network. Replacing the electronic switch with a digital-to-analog converter and then adding another digital-to-analog converter will successively improve the amplitude-frequency and phase-frequency characteristics of the stereophonic signal for high-fidelity stereophonic broadcasting. Corresponding addition of a non-inductive low-pass filter and removal of the now unnecessary phase corrector transforms the MOD-15 modulator into a MOD-17 one. Demodulation (decoding) of the complex stereophonic signal can be effected by amplitude detection, by sum-difference conversion with detection of the ultrasonic component of the polar-modulated oscillation, or by time division of channels. Series K594PA1 and series K174KhA14 integrated circuits are available for stereophonic modulators and demodulators, respectively. Figures 8; tables 1; references: 8 Russian.
[93-2415]

UDC 621.391.28

SOME DEVELOPMENT TRENDS IN ELECTRICAL COMMUNICATION

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received,
after completion, 22 Jun 83) pp 45-48

ZAKHAROV, G. P.

[Abstract] Statistical and financial data indicate that the major worldwide trends in electrical communication, specifically telephone communication, are continued growth of a demand for services with correspondingly increasing

capital investment accompanied by a decrease of operating costs. These trends are stimulated by introduction of electronic and quasi-electronic automatic switching as well as by changeover to integrated-service digital networks with channel switching, message switching, or hybrid switching. All three forms of integrated-service digital networks have been and continue to be evaluated comparatively with respect to technical feasibility and cost effectiveness as well as reliability and structural optimization. Figures 1; tables 2; references 17: 10 Russian, 7 Western.
[93-2415]

UDC 621.391.82.001.24

FREQUENCY SELECTION FOR DISPERSION SIGNAL IN SATELLITE COMMUNICATION LINES

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 24 Nov 83)
pp 8-10

DOROFEYEV, V. M.

[Abstract] Interference produced by a satellite communication system in other communication systems operating at the same frequency band is suppressible by dispersion of the transmitted energy. This method is used in "one channel per carrier" systems, which have particularly low interference immunity. Examples are SPADE and SCPC systems, both using pulse-code modulation and phase keying. Selection of the frequency for a dispersion signal requires determination of the maximum allowable interference level in the presence of a fast dispersion signal, the frequency of the latter being either equal to or higher than the scan-line frequency. Here this determination is made analytically, by estimating the error probability in a "one channel per carrier" channel. The maximum allowable level of dispersion interference is then related to this error probability, assuming that presence of such an interference will increase the error probability from 10^{-7} to 10^{-6} as a basis. Because a fast dispersion signal may produce interference in other communication systems such as radio relay links on the ground, by beating the discrete components of tone-frequency FM signals, and furthermore is not easily compensated on the receiver side, it is preferable to use an additive mixture of fast and slow dispersion signals so as to ensure an overall optimum selection. Figures 7; references 3: 1 Russian, 2 Western.
[98-2415]

IMPROVEMENT OF PUBLIC TELEGRAPH SYSTEM BY INTRODUCTION OF MESSAGE SWITCHING CENTERS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 12 Mar 84) pp 19-21

ZHEVLYUK, K. S. and TUYKIN, R. A.

[Abstract] Message switching centers using two VK-1033 computers have been introduced into public telegraph systems since 1981, and will eventually replace all existing and obsolescing LIMAN and ATOL telegram processing systems. Eight such centers are already in service (Yerevan, Novosibirsk, Khabarovsk, Moscow oblast, Leningrad, Tashken, Krasnoyarsk, Sverdlovsk), four are in preparation for service (Chelyabinsk, Gorkiy, Rostov-na-Donu, Krasnodar) and five more are being built. They operate in either of two modes, some with "load separation" and others in "parallel", each mode having its advantages and drawbacks. Experience will determine which mode is better. In the meantime, a capacity of 480 channels has already been attained in the "load separation" centers. The target speed of 6 telegrams/s has not yet been attained, the speed now being 3 telegrams/s during weekdays and 4 telegrams/s during holidays. Each center operates in real time, upon either manual or automatic starting of the "driven" computer. Operation of telegraph offices with these computerized message switching centers requires special skills and various aids, such as display panels for indexing of telegrams and magnetic disks or tapes for permanent filing. Operation of telegraph offices by the "message switching + channel switching" method significantly reduces overall labor and duplications. Still needed are better control of equipment warmup and operating temperature, better reliability including fail-maintenance and repair. Figures 1; references: 3 Russian.

[98-2415]

METHOD OF REMOTE INSPECTION OF SUBSCRIBER LINES IN RURAL TELEPHONE NETWORK

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received, after completion, 9 Mar 82) pp 27-29

GRANAT, S. M. and YELEKOYEVA, E. K.

[Abstract] A method and the apparatus have been developed for remote inspection of subscriber lines in a rural telephone network from the technical service center. The equipment consists of a connection terminal at the central station and an inspection channel from operator console to subscriber line. Inspection is made directly, with a line switching device included in that channel. A test signal is sent to the given line while an intercept signal is sent to the opposite end of the transmission channel.

Conversation is heard when the line is functioning and busy, testing being postponed till the line becomes free. Silence or a "busy" signal indicate a defective line, a "ringing check" signal indicates that the subscriber whose line is checked waits for the other party to answer the phone. Here again various responses indicate various states of the line and require the inspector to act in different ways, depending on whether or not the subscriber whose line is checked can be interrogated. The procedure and the equipment can be adapted to inspection of home or office as well as coin booth telephone lines. Figures 1; references: 3 Russian.
[98-2415]

UDC 621.394(395)

DESIGN OF COMMUNICATION NETWORKS WITH ALTERNATE ROUTES HAVING NONCOINCIDENT PEAK LOAD HOURS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 27 Jul 83)
pp 22-24

VRAZHNOV, V. N. and DUBROVINSKIY, V. M.

[Abstract] Three methods of designing communication networks with direct and alternate routes are compared with the conventional method of determining the number of channels in direct routes for peak loads, taking into account noncoincidence or shift of peak load hours in the various direct routes. In the first method conventional design is combined with determination of the capacity of alternate bundles, taking into consideration the real time distribution of the total excess load. In the second method the conventional design is followed by estimation of the service quality during off-peak hours. The third method is "multihour" optimization. Each method is applied to a simple network consisting of two direct bundles and a common alternate one for both, with the total excess load assumed to have a Poisson distribution. A comparative evaluation of all four designs, in terms of the required numbers and capacities of channels, indicates that "multihour" optimization is most effective. This method is still a semiempirical one, its load equalization in the alternate bundle and cost equalization requiring further theoretical analysis. Figures 1; tables 1; references 9: 5 Russian (2 ITTCC), 4 Western.
[98-2415]

TEST RESULTS ON K-1920P LINE CHANNEL EQUIPMENT

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 84 (manuscript received 16 May 84)
pp 19-25

BUTLITSKIY, I. M., GEDOVIOUS, O. G., ZAYTSEVA, L. A. and USHEROVICH, Ye. A.

[Abstract] The equipment of a 246-km long K-1920P communication line segment between two attended repeater stations was tested for performance characteristics, namely bandwidth, maximum range, load capacity and average power per channel, overload threshold, and noise power. The line equipment includes amplitude-frequency correction, automatic gain control with over-regulation, and telemechanics for remote supervision via service communication with use of special filters. It is based on standard K-3600 components and auxiliary K-24R distribution components. An evaluation of the results established the feasibility of lengthening the segments between attended repeater stations to 270-km without reducing below acceptable limits the stability of the amplitude-frequency characteristics and of the level diagram. This is without loss of interference immunity, and without exceeding the acceptable crosstalk level. The performance of this K-1920P equipment, tested with K-4 and K-8/6 cables, was found to be equivalent to that of existing K-1920 line equipment with electron-tube devices and of its updated K-1920U version as well as to that of VLT-1920 equipment produced in the GDR in line segments only 186-km long between attended repeater stations. Figures 6; tables 2; references 10: 8 Russian, 2 Western.
[128 2415]

UDC 621.395.4:621.311.6

ELECTRIC POWER SUPPLY FOR EQUIPMENT IN LINE CHANNEL OF K-1020S TRANSMISSION SYSTEM

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 21 Feb 84)
pp 45-48

SERGEYCHEVA, N. M.

[Abstract] The electric power supply for the K-1020S equipment, which is replacing K-60P equipment in symmetric multiquad lines must cover all unattended repeater stations between two attended ones. A line segment with up to 47 unattended repeater stations can be energized from two neighboring source points through feeder half-sections. A line segment with more unattended repeater stations (up to a maximum of 94) must be energized through feeder half-sections. The power supply for such 3.2-140 km long line segments is a converter which chops the 24 V d.c. voltage of a primary source into 20 kHz voltage pulses and feeds the latter to a step-up transformer. On the secondary side of the transformer the voltage is rectified and

filtered, after passing through a bank of 3 fixed and 2 adjustable power amplifiers, to provide a constant current of 100 ± 5 mA to the load under a voltage regulation over the 36-900 V range. The current is stabilized through voltage control by two mechanisms: coarse discrete regulation by automatic cut-in or cut-out of amplifiers, and by fine smooth regulation by adjustment of the pulse width of amplifier output voltages. Synchronization and protective interlocking are provided, with signalization. Control and commutator switching modules are built with full circuit integration. Figures 3; tables 1; references: 4 Russian.
[80-2415]

UDC 621.395.44:621.315.212

K-10800 TRANSMISSION SYSTEM

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 13 Dec 83)
pp 1-5

MAMONOV, Ye. S., LEBEDEV, A. V., ZHUKOV, I. N. and GURIN, O. I.

[Abstract] With the new K-10800 transmission system it will become feasible to organize up to 21,600 long-distance telephone channels over the 4,332-59,684 kHz frequency spectrum, over up to 830 km long KM-4 coaxial cable pairs in the most economical manner. The conductor size for the cables has been selected on the basis of minimum total fixed and variable costs. A comparative analysis of this system and the existing K-3600 system with up to 7200 channels only confirms the advantages of the new system as evident in the number and layout of uncontrolled repeater stations, up to 80 between two terminal stations with automatic regulation in each and correction of amplitude-frequency characteristic in every twentieth, as well as semiattended and fully unattended repeater and supply stations. Automatic regulation includes compensation for temperature changes, by means of thermistors, and for cable length - with minimum loss of noise immunity. Another important feature is automatic maintenance. Inspection and monitoring of the line from a central point at one terminal station are facilitated by an SM-4 computer with necessary peripheral equipment which processes data from KS-100 measuring instruments along the line transmitted by zonal, continuous-duty, and periodic-duty telemetry. The new K-10800 system still needs to be comprehensively tested on a pilot line, prior to its installation during the 12th Five-Year Plan period. Figures 4; references: 1 Russian.
[80-2415]

INTERACTIVE METHOD OF SECONDARY COMMUNICATION NETWORK RATIONAL GRAPH SYNTHESIS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 15 Apr 82) pp 29-33

MIKHEYENKO, V. S.

[Abstract] An interactive method, with the computer operating in the dialog mode, is developed for construction of a rational line diagram for a proposed new secondary communication network or for modernization of an existing one. The locations of all switching stations are assumed to be known and only channels of the existing nationwide primary communication network are to be utilized. The diagram is designed to ensure the necessary probability of making station-to-station connections for principal message transmission. The capacity of primary network channels is assumed to be unlimited, which removes constraints on the capacity of secondary network channels. The interactive method maximizes utilization of computer capacity and of engineering creativity. It is based on the theory of graphs and subgraphs. The engineer defines and conceptualizes the network, whereupon the computer generates possible variants of graphs and selects the one with the optimum topological structure so that efficiency is optimized and all other performance indicators remain within acceptable limits. The method begins with an heuristic approach to problem solving and concludes with optimum search, which also involves ranking. The 12-step algorithm has been programmed for a YeS-1035 computer. It was executed for a secondary communication network with 20 switching stations and a connectiveness not lower than 0.95 of station pairs. Calculations yield the distances between stations according to the optimum graph and the connectiveness of station pairs over lines represented by branches between nodes on that graph. Figures 3; references 12; 11 Russian, 1 Western (in Russian translation). [98-2415]

UDC 621.395.345

MARKET RESEARCH DEALING WITH URBAN TELEPHONE SYSTEM SUBSCRIBERS' INTEREST IN ADDITIONAL SERVICES

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received, after completion, 19 May 83) pp 33-35

AKHMEDOV, N. A. and POKROVSKIY, N. B.

[Abstract] There is a need for more thorough sociological study of urban telephone system subscribers', by polling and statistical data analysis, to determine their interest in additional services. Some such studies were made, and the results evaluated in the form of histograms. Two examples

of additional services are touch dialing of most often used numbers and automatic pickup plus message recording. Such a study is combined with a cost analysis, for determining the economics of providing desired services. A good illustration is the Baku Telephone System, which has provided typical results for such a study. Figures 2; references: 3 Russian. [80-2415]

UDC 621.396

SELECTION OF FREQUENCY CONVERSION FOR QUASI-OPTIMUM ADAPTATION ALGORITHM IN FREQUENCY DOMAIN

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 10, Oct 84 (manuscript received 24 Nov 83) pp 76-77

GALCHENKOV, O. N.

[Abstract] Frequency conversion by transformations of the sinusoidal family is considered for faster adaptation of nonrecursive filters, quasi-optimally in terms of minimum mean-square deviation and with minimum additional cost. The conventional discrete Fourier transformation is in this family, but discrete sine transformation and discrete cosine transformation also belong there. The convergence of corresponding algorithms can be measured by the proximity of the $B = (\text{diag}(R_{xx}(0)))^{-1} R_{xx}(0)$ matrix to unity ($R_{xx}(0) = Q R_{xx} Q^T$ and

$R_{xx} = M\{X[n]X^T[n]\}$ are correlation matrices of the input signal in the

frequency domain and in the time domain, respectively, Q - the operator of frequency conversion, $x[n] = (x[n], x[n-1], \dots, x[n-N+1])^T$ - the vector of the input signal, $x[n]$ - the instantaneous value of the input signal). A comparative convergence analysis of all three transformation algorithms on this basis and according to the Wieland-Hofmann relation, for a first-order Markov signal with m, k -th element of R_{xx} equal to ρ^{m-k} (ρ varied from -1 to +1), reveals that the discrete sine transformation is better when $N \leq 64$ and the discrete cosine transformation is better when $\rho > 0.6$, all three transformations being almost equally efficient when $N > 64$. Figures 1; tables 1; references 5: 2 Russian, 3 Western (2 in Russian translation). [118-2415]

NEW MULTIPROGRAM UHF FM RADIO STATION 'DOZHD'-4' FOR STEREOPHONIC BROADCASTING

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 4 Aug 83)
pp 37-40

KALININ, L. B. and MONZELER, S. G.

[Abstract] The existing "Dozhd'-2" UHF FM radio station is being thoroughly modernized into 2-program and 4-program "Dozhd'-4" versions for both monophonic and stereophonic broadcasting. Programs are fed to a sound level regulator in a low-frequency bay: monophonic programs through A channels only, stereophonic programs through A channels and B channels. In the bay is also contained equipment for switching low-frequency signals as well as of signals for visual and aural monitoring of programs, including automatic signal level maintenance. A distinguishing feature of this radio station is the 66-73 MHz program transmitter with an 80 W preexciter-pre-amplifier stage on transistors and a 2.5 kW output stage on a vacuum-tube beam tetrode. The preexciter has a 5 MHz single quartz and a discrete (0.01 MHz steps) frequency grid. The carrier frequency is modulated with a monophonic signal and a complex stereophonic one, by a frequency synthesizer built on the basis of an automatic phase-lock frequency control with an adjustable frequency divider in the feedback loop. The preamplifier consists of three transistor stages (KT922B, KT922V, KT971A). Conversion of A-channel and B-channel signals into a complex stereophonic one is effected by polar modulation with a MOD-16 modulator. Additional features include visual tracking of stereophonic signals and a VHF band-separation filter facilitating buildup of the number of transmittable programs, also "Bumerang" remote-control and alarm equipment. Figures 4; tables 1; references: 6 Russian.
[93-2415]

UDC 621.396.41.037.372

DESIGN OF EXPERIMENTAL DIGITAL RADIO RELAY SYSTEM FOR TRANSMISSION OF STEREOPHONIC AND MONOPHONIC BROADCASTS

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 7 Sep 83)
pp 34-36

GUK, N. I., DVORETSKIY, I. M., MINKIN, V. M., RAKHMANOV, S. Yu. and SHCHERBAKOV, V. D.

[Abstract] An experimental digital radio relay system for both stereophonic and monophonic broadcasting has been built and tested. The digital transmission channel is based on existing analog radio relays modified to a 2048 bit/s capacity. It consists of analog-digital sound broadcasting equipment, a digital cable line, and a digital radio relay line. Sound

broadcasting equipment from the 1980 Moscow Olympics is used here. The digital cable line connecting radio broadcasting equipment to radio relay equipment is based on the standard pulse-code-modulation system. The digital radio relay line is fitted into the analog radio relay broadband channel. The performance of this system was measured according to the International Radio Consultive Committee (CCIR) A-B-A-B method (A- signal passing through acoustic etalon, B- signal passing through tested channel) by musicians, audio technicians, and GKTR service specialists. Four kinds of music (xylophone, piano, symphony orchestra, concert band) and speech were transmitted for testing purposes. As the basic performance indicator is regarded the fraction of total time during which the transmission error exceeds a given threshold, immunity to psophometric noise being defined according to CCIR recommendation 505 if 60, 56, 48 dB is not exceeded for, respectively, 20, 1.0, 0.1% of the time. The test results confirmed the feasibility of high-fidelity transmission of telephone signals as well as GKTR programs stereophonically and "Mayak" programs monophonically according to International Consultive Committee for Telephone and Telegraph specifications. Tables 2; references 3: 2 Russian, 1 Internat'l (CCITT). [93-2415]

UDC 621.396.43

METHOD OF CALCULATING CROSSTALK NOISE IN RADIO RELAY LINKS BY HARMONIC ANALYSIS OF FREQUENCY CHARACTERISTIC OF GROUP LAG TIME

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 4 Nov 83) pp 16-20

TARTAKOVSKIY, L. S.

[Abstract] A method of calculating the crosstalk noise in radio relay links with several antenna-waveguide channels is proposed, a method more accurate than approximate estimation of the group lag time T_0 over one span and its nonuniformity $\Delta T_0 = T_{0,max} - T_{0,min}$. The method involves expanding the

frequency characteristic of group lag time $T(f)$ into a Fourier series, with $\delta f = f - f_{min}$ (radio-frequency range) or $\delta f = F - F_{min}$ (intermediate-

frequency range). From the spectrum of group lag time the segment is then extracted which corresponds to crosstalk noise. A comparison of this segment with the corresponding Fourier series will reveal reflections and mode transformations by inhomogeneities between neighboring channels, both generating secondary noise fluxes along the main crosstalk flux. The method applies also to telephone channels in a radio relay link. Calculations made for a radio relay link with two antenna-waveguide channels, covering alternately the 59-79 MHz range and the 56-80 MHz range, indicate that this method yields results not differing much from results of measurements. Inasmuch as the frequency characteristic of group delay time is statistical in nature, this method has broad implications. The author thanks

S. V. Borodich and B. S. Nadenenko for helpful suggestions. Figures 3;
references: 6 Russian.
[80-2415]

UDC 621.396.79:621.391.25

SELECTION OF PREDISTORTION AND RESTORATION CIRCUITS FOR ENCODER-DECODER
EQUIPMENT IN DIGITAL TRANSMISSION SYSTEMS WITH PULSE-CODE-MODULATED
BROADCAST SIGNALS

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 21 Jul 82)
pp 62-64

VYKHODETS, A. V., DENISOV, V. I., RABINOVICH, G. V. and RUDNYY, Ye. M.

[Abstract] Five types of predistortion and restoration circuit pairs (A,B,C,D,E) for use in an encoder-decoder operating in a digital transmission system with pulse-code-modulated broadcast signals are comparatively evaluated. The evaluation is based on subjective tests and on statistical analysis of experimental data. The circuits were tested in a 9-digit coder simulating a digital transmission system with nonlinear encoding and an A-87.6/13 compression characteristic. Radio signals with pulse-code modulation were transmitted from an MEZ-28A magnetic tape recorder in the studio to the kodek and from the latter to a high-grade "Brig" amplifier, carrying segments of solo violin, piano, and vocal music as well as of orchestral and band music. Testing group consisted of five male and two female music lovers without formal music education. The results indicate that noise perception depends on the form of music, being keenest with piano and orchestral music. According to this subjective-statistical comparison, type D is the best and type A is the worst. These ratings are tentative, however, depending on the standard deviation. Although types C,D,E do not differ too much from types A and B, type A, however, has a least nonuniform amplitude-frequency characteristic and thus causes least attenuation so that it requires least amplification in the analog part of the kodek. For reference, the performance characteristics of type D were also compared with those of the standard analog type J predistortion and restoration circuit pair. Figures 2; tables 2; references 9: 6 Russian, 3 Western (1 in Russian translation).
[93-2415]

SOME PROBLEMS IN DEVELOPMENT OF STEREOPHONIC RADIO BROADCASTING

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 pp 3-5

VARBANSKIY, A. M.

[Abstract] Although the trend in television broadcasting is unmistakably from black-and-white to color images and a complete changeover is imminent within 5-10 years, no comparable trend from monophonic to stereophonic radio broadcasting is yet in evidence. One major reason is that the advantages of stereophonic radio broadcasting have not yet been unequivocally established. While means and methods of stereophonic sound transmission are being developed by experts, the trend is set by the lay consumer rather than by the professional producer. One problem is that effective stereophonic reception requires not only a high-quality signal but also an appropriate listening environment. It has been established so far that stereophonic sound is of a higher quality than monophonic sound even under unfavorable conditions. Various pseudostereophonic systems have been developed on this premise, the basic principle being that monophonic sound is split electrically into two sounds with different intensities or in different regions of the frequency spectrum, or both different. There is some general analogy between trends in television broadcasting and in radio broadcasting such as development stages and network expansion, but there is a difference in the rate of innovation. Changes in the mode of radio broadcasting are impeded by the lesser flexibility of existing channels, stereophonic transmission imposing special requirements. The changeover in this case thus largely depends on development of suitable channel equipment and suitable signal configurations. Current practice is to transmit either two separate stereophonic signals, one for the left ear and one for the right ear, or a single complex one. Simpler equipment in the radio studio is needed for one complex signal, a wideband FM modulator serving the purpose, but the channel bandwidth must be correspondingly larger. At this time a-l means facilitating changeover to stereophonic radio broadcasting are already available, including the digital technique combined with microelectronic circuitry and components. Radio receivers with stereophonic channels are already produced and studio equipment is being appropriately modernized. Only the problem of measuring instruments has as yet not been solved. Considering that the 63-73 MHz frequency band is already assigned to monophonic FM broadcasting, it will be most expedient to assign the 100-108 MHz frequency band to digital stereophonic FM broadcasting. Another innovation considered and tried is stereophonic sound tracking of television broadcasts. However, the technical difficulties associated with the small screen size and the only subordinate role of sound in the information reception process may perhaps not justify further developments in this direction.

[93-2415]

TRENDS IN DEVELOPMENT OF STEREOPHONIC RADIO BROADCASTING IN USSR

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received, after completion, 26 Jul 84) pp 6-12

YUSHKYAVICHYUS, G. Z., KHELEBNIKOV, V. I. and NIKONOV, A. V.

[Abstract] Until 1980 stereophonic broadcasting in the USSR was completely decentralized, with UHF FM channels from each city with a radio station. Stereophonic transmission over interurban audio channels with conventional AV-2/3 equipment is not possible without special phase correcting devices. Partial centralization should become feasible via satellite and over new ground channels, with programs originating in Moscow for transmission to republics and localities. At the present time stereophonic programs are produced in 41 cities and broadcast for 2-11 hours daily, in addition to which stereophonic programs are relayed from 13 cities (including three from Moscow, three from Kiev, two from Tallinn) adding up to a total of 195 program-hours daily. By 1985 the stereophonic broadcasting network will cover 80 cities, with four central programs and two republican programs added to the repertoire everywhere. The most important factor inhibiting the expansion of stereophonic broadcasting is shortage of stereophonically recorded material. Other problems requiring attention are quality of broadcast phonation, production of stereophonic programs in the studio, technical level of studio equipment, adaptation of program pickup channels, increasing the number of stereophonic UHF FM transmitters above the 50 existing ones and replacing the already obsolescing bays, producing receiver sets and receiver antennas of adequate quality for a mass market with attendant changeover from vacuum tubes to transistors. According to available indicators of progress in the Soviet Union and abroad, most promising will be stereophonic broadcasting in the 100-108 MHz frequency band and on medium waves, wire stereophony, binaural stereophony, and stereophonic sound tracking of television broadcasts. Figures 3; references: 22 Russian. [93-2415]

UDC 621.396.97.001.24

PROSPECTIVE NETWORK OF STEREOPHONIC CHANNELS FOR SOUND BROADCASTING

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 2 Aug 84) pp 31-33

KOTIKOVA, R. A., MISHINA, Ye. G. and PETROV, M. S.

[Abstract] In the 1990-2000 year period stereophonic channels with both analog and digital equipment will be laid out for radio broadcasting according to audience and territorial coverage projections. This stereophonic network will be a centralized one, with programs originating in Moscow. It

will be incorporated into the general nationwide radio network, which covers 5 time zones from the far East to the Western border with broadcasts of All-Union, republican, and local programs. This general nationwide radio network constitutes, in turn, a secondary network in the nationwide Unified Automatic Communication System. For stereophonic radio broadcasts the country will be subdivided into regions roughly conforming to the administrative regions and time zones, with the center of each integrated with the corresponding control center of the primary network, and with terminals located at republic, kray, or oblast centers. Programs will be transmitted from central program distribution centers (TsURP) over trunk lines to regional nodal main broadcasting stations (RUMVA), a standby channel being available to each RUMVA. Switching and control equipment necessary for transmitting the centralized stereophonic version of a "Mayak" program to all 2-program and 4-program UHF FM stations via radio relay links or "Orbita RV" satellite will be installed. Furthermore, use of pulse-code modulation-analog-to-digital conversion equipment will facilitate establishment of three stereophonic or six high-class channels. Figures 2; references: 7 Russian. [93-2415]

UDC 621.396.97:681.84.087.7

STEREOPHONIC BROADCASTING NETWORK IN LATVIAN SSR

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 16 May 83) pp 41-44

YEKABSON, I. Ya., PANKIN, S. V. and YAUYA, S. Ya.

[Abstract] The stereophonic broadcasting network in the Latvian SSR was built in 1967, in which year experimental local broadcasting over radio channels from Riga had also begun. No major developments followed until the late nineteen seventies, when a long-distance stereophonic broadcasting system was developed in the Estonian SSR, and since then a system for zonal stereophonic broadcasting from Riga over telephone channels of radio relay links is being developed, installed, and operated in the Latvian SSR. The "Dozhd'-2" UHF FM radio station is being supplemented with two bays of wideband exciters, for "mono" operation and "stereo" operation. The necessary complex stereophonic signal is formed from low-frequency A-channel and B-channel signals by polar modulation in a set of MOD-15 modulators and transmitted from the central station to a peripheral one over a radio relay link where old R-60/120 equipment has been replaced with new KURS equipment. The transmitter of the complex stereophonic signals has stabilized automatic phase-lock frequency control from a 96 kHz oscillator. There is also an FM control demodulator of the 2.5 MHz carrier included, for monitoring the transmission as well as setting and checking the frequency deviation with the aid of appropriate KIK measuring and testing instruments. Pilot operation of this system has established the feasibility of zonal stereophonic broadcasting with noise level, nonlinear distortions, and nonuniformity of amplitude-frequency and phase-frequency characteristics within acceptable limits. Figures 5; tables 1; references: 4 Russian. [93-2415]

STEREOPHONIC RADIO BROADCASTING SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 10, Oct 84 (manuscript received 3 Oct 83)
pp 16-20

KONONOVICH, L. M.

[Abstract] In the Soviet Union stereophonic FM radio broadcasting is done by polar modulation, not of the carrier signal directly but of the complex stereophonic signal generated as a result of partial carrier suppression. The upper and lower envelopes of such a complex stereophonic signal are modulated by signals in the left-ear channel and in the right-ear channel, respectively, according to the equation

$$u_c = (L + R) + \left(\frac{1}{k} + L - R\right)\sin\omega t.$$

The subcarrier frequency is 31,250±2 Hz, the subcarrier suppression factor is $k = 5$ equivalent to 14 dB, the frequency band is 0.03-15 kHz with the complex stereophonic signal having a 0.03-46.25 kHz spectrum other performance characteristics such as signal-to-noise ratio (30-36 dB at 1000 Hz) and signal-to-hum ratio depending on the equipment. This system differs from the American stereophonic system with pilot tone, where the complex stereophonic signal is modulated according to the equation $u_c = (L + R) + (L - R)\sin\omega t + P\sin 1/2\omega t$. Either system can be used for stereophonic sound tracking of television broadcasts, another important application being stereophonic AM radio broadcasting. Three possible major methods here are double modulation (transmitter carrier signal amplitude-modulated by $L + R$ sum signal and frequency- or phase-modulated by $L - R$ difference signal), separation of modulation sidebands, and quadrature modulation with two AM signals of the same frequency and in phase quadrature. Two new trends, stimulated by successful developments, are stereophonic wire broadcasting to which the present 3-program system is particularly adaptable and digital stereophonic broadcasting which is preferable in multichannel systems where digital encoding contributes to stability of channel characteristics. Figures 6; references: 3 Russian.
[93-2415]

'INTERKOSMOS' PROGRAM OF SPACE COMMUNICATION DEVELOPMENT

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 6 Apr 84)
pp 1-3

KANTOR, L. Ya.

[Abstract] Countries participating in the "Interkosmos" space communication development program are Bulgaria, Cuba, Czechoslovakia, the GDR, Hungary, Mongolia, Poland, Romania and the Soviet Union, and, as observers, representatives of the board of directors of the international organization "Intersputnik". Joint task groups from these countries are currently working in eight separate areas of development: 1) utilization of new frequency ranges, particularly the 10-30 GHz range, for satellite communication (GDR the coordinator country); 2) optimum methods of signal transmission via satellite on the basis of the latest available technology, including multiple-access systems (Hungary the coordinator country); 3) implementation of principles of interaction between satellite and earth communication systems (Soviet Union the coordinator country); 4) development and optimization of complete equipment for ground stations of satellite communication systems (Soviet Union the coordinator country); 5) suppression of mutual interference between satellite communication systems and ground services, combined with more effective utilization of geostationary orbits (Czechoslovakia the coordinator country); 6) development of satellite television broadcasting systems in 12-GHz frequency band, construction of prototypes and experimental operation (Poland the coordinator country); 7) [text missing]; 8) development of low-noise receiver devices, among them parametric and transistor amplifiers for 3.7-4.2 GHz, 11-12 GHz, and 20-30 GHz ground stations (Bulgaria the coordinator country). For the next Five-Year Plan period development is scheduled of systems with highly directional antennas for processing satellite communication signals. References: 4 Russian.
[98-2415]

PRELIMINARY ESTIMATION OF MUTUAL INTERFERENCE BETWEEN FIXED SATELLITE SERVICE SYSTEMS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 10 Jan 84)
pp 4-7

BORODICH, S. V.

[Abstract] Prior to licensing a new fixed satellite service at the International Frequency Registration Board, it is necessary to estimate the level of interference between this and existing fixed satellite service

systems. The method of preliminary interference estimation according to the International Radio Consultative Committee 454-3 and 455-3 regulations for geostationary satellite networks sharing the same frequency band is applicable to any system regardless of signal form and modulation type, as well as regardless of the exact carrier frequency. A preliminary estimation involves determining the relative increment of equivalent noise temperature which is produced in one satellite channel by interference signals from another, assuming that an interference signal is equivalent to thermal noise of uniform spectral power density equal to the maximum disclosed in the application for license. Accordingly, such preliminary estimates are based on fundamental relations for the useful signal in the presence of thermal noise with the intermodulation component of noise taken into account. These relations are derived here for satellite telephone channels in a system with frequency modulation of analog signals and with frequency division multiplex, in a system with phase keying of digital signals and time division multiplex, in a "one channel per carrier" system with pulse-code modulation and phase keying, as well as for various combinations of these useful signals and interference signals. These relations yield conservative estimates. No coordination between satellite service systems is required when the increment of noise temperature does not exceed 4%, coordination with more precise estimation of mutual interference being required otherwise. Tables 3; references 11: 3 Russian, 8 Western (IRCC). [98-2415]

UDC 656.254.16.004.2:656.342

RADIO COMMUNICATION FOR SUBWAY OPERATION AND ENGINEERING SERVICES

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 10, Sep 84
(signed to press 21 Sep 84) pp 4-7

VAVANOV, Yu. V., Head of VNIIZhT laboratory, candidate of technical sciences, KAMENEVA, E. B., senior scientist, and ALMAZYAN, K. K., junior scientist

[Abstract] Normally, the same radio equipment is used for radio communication in subway operation and engineering services as for surface railroads. Radio units of the ZhR-U type are presently manufactured by industry, while the complex radio system "Transport" is being developed. There are three types of service communication employed by surface railroads; they are the train, station, and the repair-maintenance communication links. Similar types of communication are necessary for subway operation, but except for the train-dispatcher communication no other types have yet been fully developed. The principal type of communication in the subway is the dispatcher-train radio link, which under normal operating conditions is used for controlling the traffic, and due to the voice contact features assures a speedy response. Subway stations carrying a large number of passengers employ other types of communication, which provide contact between the traffic controller on the station and the train dispatcher and machine operators. In addition,

using the public address system, the traffic controller on duty makes announcements to the passengers. Also the repair shop personnel must be in communication with the machine operators, maintenance men, service personnel, mobile repair vehicles, etc. At the present time stationary, transportable radio units of ZhR-U type and portable units of "Transport RN" type are available for this purpose. A system assuring a high reliability of operation is suggested, which would provide a continuous communication link in tunnels up to 56 km long in case of malfunction, and which employs a second permanent radio station located in the middle of the dispatcher-controlled section and includes terminal permanent stations at each end. It is also suggested that the traffic controllers should be equipped with portable units of the RN-1 or RN-2 type. The RN-3 type can be used as a stationary unit with the antenna mounted on the roof of the depot building for contact with the repair crew and the service personnel. The RN-4 units are under development by industry and would provide for a remote-controlled connection to the public address system at the stations. The RN type units can operate at five different frequencies which allows their employment with different circuits. Figures 4.

[103-12755]

UDC 656.259.2:621.317

EQUIPMENT FOR TESTING LOCOMOTIVE SIGNALING DEVICES

Moscow, AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 10, Sep 84 (signed to press 21 Sep 84) pp 7-10

ZDOROVTSOV, I. A., Department head of the design bureau for the main administration of signalling and communication in the Ministry of Transportation, KHRUMUSHKIN, D. N., LYUBIMOV, V. I., and KOCHNEV, A. V., Leading designers TsIPEN'YUK, I. Ya., Design engineer of the design bureau for the main administration in the Ministry of Transportation

[Abstract] Automatic railroad traffic regulating systems located at control electronic interlocking points are now finding more frequent application in Soviet railroads. A new automatic locomotive signalling (ALS) system with a combination frequency division code was developed, capable of operating in parallel with a numeric ALS code. Automatic locomotive **signaling test-instruments**, ILS-4 and KPP-ALS were designed by the All-Union Scientific Research Institute of Railroad Transportation for testing the performance of the ALS digital and frequency code locomotive devices under field conditions. This equipment passed laboratory and field tests and is ready for a serial production. The automatic locomotive signaling test instrument ILS-4 can also detect malfunctions in locomotives equipped with numeric and frequency automatic locomotive signaling apparatus for subways and street cars. The ILS-4 is an improved model of the ILS-3. The instrument's functioning is comprehensively described and the electronic circuit is provided. The ILS-4 is powered by 50 ± 7.5 v dc with power consumption not greater than 100 W. The weight of the instrument is 7 kg. The

ILC-4 is assembled in a metal case and is readily transportable. The dimensions are 422 x 254 x 150 mm. The ILS-4 tester is presently manufactured by the electroengineering shops of the Northern Railroad. The ILS-4 is protected by patent No 1030231. Figures 6.
[103-12755]

UDC 656.254.151.2

APPLICATION OF SIMPLIFIED FUNCTIONAL CIRCUITS FOR TRAFFIC CONTROL AT ESK 400E STATION

Moscow, AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 10, Sep 84 (signed to press 21 Sep 84) pp 28-31

KHRAMCHENKOV, S. I., Senior engineer, Automation, remote control, and communication laboratory of the Baltic Regional Railways

[Abstract] This item is a continuation of the articles in ATIS, no 1,3,4,7, 1984. The WE/KA program is developed for establishing outgoing external corrections in the railway telephone communication. The program is executed after the characteristic digit of the outgoing communication is dialed by the user. This disconnects the earlier connection of the user line with the cord set, and a new contact with the RSL set is thus established. The algorithm of the WE/KA program contains 13 consecutive steps. First, the register address is determined, which results in tripping an appropriate relay and allows the register to pass the information to the analyzer. For illustration an analysis of the dialing information is made for a case of dialing zero as an index for making a contact with the ATS, followed by a request for executing the outgoing external contact, which is initiated after a negative potential is generated in the circuit. The determination of the caller's cord-set address is made and opens the way for vacating the connecting line between the user's and the cord-set and forming a new connection between the caller with the input to the RSL. The caller's address is determined beforehand by the identification method. The caller's address is then transmitted to the switching circuit after activating the appropriate relays. The priority category is established for each YeSK-400Ye user to ascertain his right to access the outgoing external communication line. After activating the appropriate relay the communication line is opened between the caller and the cord-set while the cord-set and the register are simultaneously cleared. The further functional steps of the WE/KA program will be examined in the next issue of the ATS.

Figures 2

[103 -12755]

DEVICE FOR MEASURING PARAMETERS OF THE LONG-DISTANCE AUTOMATIC COMMUNICATION SETS

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 10, Sep 84 (signed to press 21 Sep 84) pp 31-35

GULYA, Ye. M., Engineer of the Odessa Railroad, Odessa section, BUGAYENKO, V. I., Electromechanic

[Abstract] No universal device for checking the required parameters of the long distance automatic communication sets (DKDN, PGP-4, DATS, PTNV and GTNV) is presently available for use in the railroad transport communication network. Such a device has been developed and field tested in the wire communication laboratory of the engineering and maintenance section. The device can automatically specify all possible states of the tested set circuit and is capable of measuring the duration of the engaged pulses, the dialing of the digits, and the ring-off. It can also measure the pulse repetition rate, attenuation, frequency and the level of the output signal, as well as the deviation in frequency and signal level due to fluctuations of the power supply voltage, etc. The device contains a power supply unit, voltage stabilizer, square pulse generator, noise generator and a signal generator. The functional circuits, block diagrams, operating instructions and a list of the components are included in the article, which also shows a picture of the device's front panel. All units of the device are made of printed circuits using small size components. It requires on the average 17 min. for checking the parameters of the long-distance automatic communication set with the described device. Figures 6. [103-12755]

UDC 656.25.071.84

INCREASING THE EFFICIENCY AND QUALITY OF OPERATION OF THE RAILROAD ENGINEERING MAINTENANCE ADMINISTRATION.

Moscow AVTOMATIKA, TELEMEXHANIKA I SVYAZ' in Russian No 10, Sep 84 (signed to press 21 Sep 84) pp 36-38

KONOVALENKO, A. A., Senior engineer of the Technical Repair Administration for Far East Railway, Ruzhino section.

[Abstract] Procedures for repair maintenance and replacement of the automatic and remote controlled signal equipment for centralization and blocking at Ruzhino section of the Far East Railroad were developed and are operational. These procedures specify the structure, methods and principles of the engineering process, as well as the composition and responsibilities of the working personnel and their functions in accordance with the directives issued by the Ministry of Railroads. A system of performance, quality and quantity control was introduced, requiring registering all violations of the procedures in accordance with a special form which is given in the article. This procedure allowed improvements of the quality of production and a raise in the efficiency. Table 1. [103-12755]

"SPORTING" RADIO RECEIVER CONVERSION FROM R-250 M

Moscow RADIO in Russian No 11, Nov 84 pp 17-18

KURINYY, Yu. (UA9AM), international class master of sports, USSR

[Abstract] The professional communication radio receiver R-250, capable of operating over any shortwave ham range is well known. Despite high reliability and other attractive features, these receivers have inherent shortcomings, among them a limited dynamic range and poor selectivity. Simple modifications are suggested for improving some fundamental parameters. The sensitivity can be improved to 0.3 microvolts at a signal-to-noise ratio of 10 dB. The dynamic range of intermodulation can be expanded to 86 dB and the suppression raised from 90 dB to 118.5 dB. The modifications involve adjusting the input frequency, which will reduce the leakage capacitance and will require some small changes in the circuit. In order to match the gain factor of the UHF first stage with the overall gain, the 6Zh4 tube must be replaced by a 6K3 pentode, thus expanding the dynamic range. The automatic gain can be improved by introducing a trigger threshold control, and for improving the selectivity an electromechanical filter EMF 215kHz can be incorporated in the IF circuit. The modified receiver circuits are presented in the text. Figures 4.
[126-12755]

SURVEY OF DEVELOPMENTS IN TROPOSPHERIC COMMUNICATION APPARATUS

Moscow ELEKTROSVYAZ' in Russian No 11, Nov 84 p 60

NEMIROVSKIY, A. S. and MARKOV, V. V.

[Abstract] A new book was published by VOYENIZDAT at Moscow in 1984 (256 pp, 3000 copies), "Tropospheric Communication" by L. I. Ykovlev, G. V. Dedyukin, P. I. Sututon and others. The book is based on material on this subject in foreign periodical and textbook literature. It represents an updating of "Tropospheric Communication" by V. A. Antonov published by VOYENIZDAT at Moscow in 1970 (144 pp, 6500 copies). The book is written for civilian and military communication specialists and contains engineering and geographic data on worldwide existing and planned stationary tropospheric communication equipment. Tropospheric communication is compared with other modes of communication in terms of effectiveness, advantages and drawbacks. Particular attention is paid to tropospheric communication equipment needed in barely accessible polar, desert, and mountainous regions, to intercontinental tropospheric communication and to such communication between mainland and nearby islands. Much space is devoted to present development trends and projections for the future, including extensive bibliographic references. Among the shortcomings of the book are superficial treatment of communication parameters such as length of interval, unnecessarily extensive coverage of new equipment as well as its underlying physical and technical aspects. Otherwise the book is excellent and more than 3000 copies should be printed,

after revision, for the benefit of the many more designers, operators, teachers and students in both civilian and military sectors.
[128-2415]

AUTOMATIC NUMBER IDENTIFICATION EQUIPMENT FOR RURAL AUTOMATIC TELEPHONE EXCHANGES

Moscow VESTNIK SVYAZI in Russian No 11, Sep 84 pp 21-23

KHONIN, V. V., chief Leningrad oblast' Scientific Research Institute for Communications, SHIFMAN, A. N., senior engineer

[Abstract] Because of automation of the outgoing long distance communication, the rural automatic telephone exchanges must be equipped with the automatic number identification systems (DON). The Hungarian Peoples Republic manufactures servo control units for automatic number identification which consists of the subscriber number sensor and the individual subscriber programming devices APU-50. The sensor generates frequency-code combinations and transmits them to the subscriber programming device. The APU-50 distributes the sensor generated information and feeds it to the automatic switching unit (AK) of the coordinate automatic telephone exchange ATSK 100/2,000. The equipment operation is comprehensively described; block diagrams and structural circuits of the system are included. The Hungarian units employ transistors, diodes and standard relays for switching on the main and reserve units, and for signalling circuits. The automatic control system allows operating without service personnel. For domestically produced ATSK 100/2,000 and for the Hungarian units manufactured before 1978 with capacity above 500 numbers, special modification were made for placing on standard stands. A single sensor of the subscriber numbers can serve up to 400 numbers. The servo control units made by Kirov UZTA (PBI.220.032) were designed for operating together with the ATSK 100/2,000 rural telephone exchange and office coordinate ATS (UATSK) in cities, but can be used with other ATS. The automatic number identification unit AON ATSK 50/200 (M) has also been developed. It differs from the above by the method of information processing. The operation and composition of this unit is also discussed and the structural block diagram provided. Figures 3.

[122-12755]

NEW TECHNOLOGY FOR RECORDING LONG-DISTANCE TELEPHONE CONVERSATIONS WITH
ARM-20 UNITS

Moscow VESTNIK SVYAZI in Russian No 11, Sep 84 pp 27-28

LYULIN, V. F., Chief Engineer, Gor'kiy industrial-technical communications administration; TOLSTONOGOV, N. I., Chief Gor'kiy long-distance telephone exchange; OVDIY, V. F., Director of Computer Information Center; and KUZ'MENKO, Yu. V., Department Chief

[Abstract] Personnel of the Gor'kiy industrial-technical communication administration together with the computer information processing center and the long-distance telephone exchange developed and perfected the technology of accounting, inputting and processing the information for long distance telephone conversations conducted by an automatic long-distance telephone unit of the ARM-20 type. This involves conversion from punched card technique to magnetic tape recording at the engineering complex of the long-distance conversation data at the Gor'kiy exchange and its processing at the computer center. Good results were obtained, providing very reliable accounting of the long-distance conversations. The cost of the conversion amounted to about one thousand rubles, yielding a real saving of about 37.3 thousand rubles. Figures 2.

[122-12755]

COMPONENTS, HYBRIDS AND MANUFACTURING TECHNOLOGY

UDC 621.316.9:621.313.13:622

EVALUATION OF ADEQUACY OF JP54 PROTECTION LEVEL FOR LARGE ELECTRIC MACHINES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 10, Oct 84 pp 23-25

ZBARSKIY, L. A., candidate of technical sciences, TEPLITSKIY, B. Ye., candidate of technical sciences, and PORSHNEV, Yu. V., engineer, All-Union Scientific-Research Institute of Explosion-Proof and Mining Electrical Equipment

[Abstract] Testing large electric machines for adequacy of JP54 protection in contaminated atmospheres is difficult, because of a lack of large enough testing apparatus such as dust chambers and an adequate criteria for test data evaluation. Therefore, large machines must be broken up and their vulnerable components be tested by appropriate simulation of the overall structure. Such tests were performed on 200-2000 kW 6-10 kV series VA02 squirrel-cage induction motors with VZT4 or RV explosion-proofing. Cement dust was used as a soft contaminator of stator insulation, its fine dispersion and high penetrating ability matching those of the worst natural contaminators. Insulation resistance and breakdown or surface-flashover voltage were selected as safety criteria for this test, the terminal box being recognized as the most vulnerable component. Silicon dust was used as a hard contaminator of the bearing lubricant, its coarse dispersion and high abrasiveness matching those of the worst natural contaminators. Shaft coasting time, relative to shaft coasting time in ball bearings with pure grease lubrication, served as a performance indicator in this test. The results indicate that the JP54 protection level is adequate for such large motors and that the test procedure is correct. Figures 1; tables 2; references 7: 5 Russian, 1 Czechoslovak, 1 Western.
[119-2415]

METHOD OF IMPROVING DYNAMIC CHARACTERISTICS OF D.C. VOLTAGE STABILIZERS WITH COMPOUND REGULATION

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 (manuscript received 9 Dec 83)
pp 52-53

STOYANOV, G. S. and ZAKHAROV, L. F.

[Abstract] A d.c. voltage stabilizer with compound regulation is considered, with continuous feedback and pulse-width modulation. An improvement of its dynamic characteristics is proposed which will stabilize performance under both steady and transient conditions by making it independent, not only of the pulse-width-modulator transconductance, but also of the feedback-amplifier gain. This is achieved by addition of a corrective network with two inputs and two outputs. Each output is connected to the input of a comparator, one containing a d.c. current amplifier and one containing a d.c. voltage amplifier. Each input is connected to the output of the corresponding amplifier. Furthermore, a current transducer is inserted into the continuous-regulation channel and an LCD-filter is inserted into the pulse-regulation channel. A prototype of such a voltage stabilizer was tested with a 2 A step change of the load current and this corrective network reduced the constant component of voltage stabilization error from 10.485-1.25 mV to 0.30-1.07 mV over the 18-25 V range of input voltage. It also attenuated the first overshoot in the transient response by reducing its amplitude from 0.15 to 0.04 V and its duration from 0.2 to 0.03 ms, with the entire transient period reduced from 1.5 to 0.2 ms. Figures 2; tables 2; references: 6 Russian.
[80-2415]

CALCULATION OF NOISE FACTOR FOR CASCADE WIDEBAND AMPLIFIERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian Vol 27, No 10, Oct 84 (manuscript received 3 Oct 83) pp 82-83

VALYUKHOV, V. P., KUPTSOV, V. D. and SURYGIN, A. I.

[Abstract] The method of more precisely calculating the noise factor for a 2-stage wideband amplifier by also including noise in the second stage, but in the approximation that the noise factor is nearly the same with the feedback loop closed or open, is verified by calculation of the dispersions of noise currents and emfs in the equivalent circuits with noise generators. The theoretical results for 2-stage common-emitter amplifiers agree closely with experimental data on such amplifiers with KT326B transistors. Figures 2; references 2: 1 Russian, 1 Western.
[118-2415]

QUALITY CONTROL OF RADIOELECTRONIC APPARATUS COMPONENTS ON BASIS OF EXTERNAL CHARACTERISTICS IN FREQUENCY DOMAIN

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received 28 Nov 83) pp 92-95

POKROVSKIY, F. N.

[Abstract] Measurement of impedances and other external parameters at several frequencies has been proposed for unambiguous identification of radioelectronic apparatus components in the process of their quality control. The validity of this method is established upon transformation of a complex quantity such as impedance into a rational-fractional function and subsequent polynomial series expansion of both numerator and denominator of the latter. This transformation of a measured quantity yields a linear equation containing a certain number of nonidentical groups whose vector can be arbitrarily normalized as is necessary for parametric identification of a given circuit. As an example demonstrating this procedure inspection is considered of a high-frequency (1 MHz) amplifier on a series K235UV1 integrated-circuit chip for stability of performance characteristics in time as well as during fluctuations of ambient temperature and supply voltage, under humidity and under mechanical impact. A diagnostic chart is constructed for convenient fault detection and subsequent prevention in preceding stages of the production process. This chart is based on digital computer simulation of pseudorandom parameter deviations, referring them to specific tolerance fields, and an appropriate coding of the corresponding performance characteristics. The data processing algorithms include sequential nonparametric identification and assignment of sample groups to classes according to a minimization rule with an upper bound, followed by decoding of the inspection result. The procedure is applicable to quality control in production as well as to quality control in service. Figures 1; tables 1; references 4: 3 Russian, 1 Western.
[118-2415]

CASCODE AND DIFFERENTIAL AMPLIFIER USING FIELD-EFFECT TRANSISTORS

Moscow RADIO in Russian No 11, Nov 84 pp 28-29

POLYAKOV, N.

[Abstract] Because of the small coupling between the input and the output of field-effect transistor (FET) cascode amplifiers, a high gain and stability are obtained, which are great advantages of these amplifiers. The relative complexity and a large number of parts are their shortcomings. By experimenting with FET, a cascode amplifier was designed and constructed which requires almost no resistors and capacitors. This was possible by employing FETs with essentially different cut-off voltages. Tests of the amplifier

performance revealed good thermal stability. The electrical circuit of this amplifier is described and is shown along with a circuit for a cascode resonant RF amplifier for a medium wave direct amplification receiver. A differential amplifier can also be constructed in a much similar way. This amplifier has many advantages for a variety of applications. Since it is powered by a unipolar source, it is calibrated at zero voltage for all three inputs and allows connecting any of the unused inputs to the common line. This design can be used to construct AGC amplifiers, mixers in combination with heterodynes, or mixers with separate heterodynes, etc.

Figures 4.

[126-12755]

COMPUTERS

UDC 681.3.004:621.39

STRUCTURIZATION OF PROGRAMS FOR REAL-TIME MICROPROCESSOR ARRAYS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 16 Jun 83)
pp 33-35

RAKHIMBEKOV, B. M. and VARFOLOMEYEV, A. N.

[Abstract] Computer operation in real time imposes special requirements on the microprocessor array, introducing data input randomization in time and variation of word length as well as word content in time. It therefore must be possible to vary the data processing operations and their sequence accordingly. Multiprogramming, namely simultaneous execution of several programs, is often the most expedient solution. The method of structural programming, which is based on the complexity reduction criterion and involves partition of an entire algorithm function into simpler subfunctions, requires special and advanced mathematical procedures. Resolution of an algorithm of system operation into several programs corresponding to system states at various definite instants of time is considered as a more expedient alternative for microprocessor arrays operating in real time. The feasibility of such a resolution is demonstrated for a microprocessor array operating in the synchronous mode. Comparative estimates for programming with and without such a resolution, based on semiempirical relations, indicate that resolution may increase the number of operators and correspondingly the instructions by 10% but will reduce the complexity of programs much more appreciably and the man-days of programming as well, typically by a factor of 2.65 when programs for message switching systems are written in ASSEMBLER language by a programmer with average skill. Figures 1; references 8: 4 Russian, 1 Czechoslovak (in Russian translation), 3 Western (all in Russian translation).

[98-2415]

ELECTRON DEVICES

UDC 537.311.322

ACOUSTIC EMISSION IN SEMICONDUCTOR DEVICES DURING CURRENT FLOW

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received, after revision, 4 Jan 84)
pp 91-92

KALITENKO, V. A., KUCHEROV, I. Ya. and PERGA, V. M.

[Abstract] An experimental study was made of acoustic emission in semiconductor devices during current flow, especially preceding breakdown, for possible usefulness in stress analysis and nondestructive inspection. Batches of ten D302 germanium diodes and ten P201E germanium transistors were tested, in both cases the number of pulses per unit time being counted on an oscilloscope screen and on tape after their conversion to electric signals by a TsTS-19 piezoceramic transducer and subsequent amplification. Diode measurements included current and voltage drop, acoustic emission being found to occur at a forward current above the 2 A threshold and at a reverse current from 3.5 mA (threshold) to 5.5 mA (thermal breakdown). The transistors were tested in the common-emitter connection with resistance in the base circuit. Measurements included collector voltage and current with acoustic emission found to occur at a collector voltage of approximately 50 V and a collector current from 0.5 A (threshold) to 1.5-2.0 A (breakdown). Cyclic application of voltage to diodes and transistors was found to produce an effect similar to the Kayser effect. Temperature measurements revealed a thermal effect, namely acoustic emission occurring at a temperature approximately 10° above room temperature. Both effects suggest overstressing caused by local heating as the source of acoustic emission. Acoustic emission during thermal breakdown of the p-n junction suggests a mechanism similar to that in dielectrics. Figures 3; references 3: 1 Russian, 2 Western. [118-2415]

COMPUTER-AIDED IDENTIFICATION OF COMPLETE CONSTITUTION MODEL OF TRANSISTOR STRUCTURE FOR DESIGN OF SUBNANOSECOND LARGE-SCALE-INTEGRATED CIRCUITS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received, after revision, 15 Feb 84)
pp 46-51

BUBENNIKOV, A. N. and SADOVNIKOV, A. D.

[Abstract] Computer programs have been developed for two-dimensional modeling of transistor structures with planar contact configuration in order to facilitate the design of LSI circuits with minimization of geometrical dimensions and identification of static and dynamic electrical characteristics throughout the technological process. These programs, TRAN 2 and TRAN 2M, are concerned with a transistor not only in the normal active mode but also in inversion and saturation states. Another specific application is sub-nanosecond LSI of emitter-coupled logic in the unsaturated state. Three systems of linear continuity and Poisson equations need to be solved, which both programs do by an iterative method with incomplete expansion. Electron and hole concentrations as variable in the TRAN 2 program have been replaced with the exponents of electron and hole Fermi quasi-potentials, which symmetrizes with diagonal predominance the matrices of discretized continuity equations and thus facilitates the solution of the latter. Both programs yield all necessary current-voltage and capacitance-voltage characteristics as well as the dependence of the collector-emitter time constant and of the current transfer ratio on the collector voltage, with the rate of convergence of the results not depending on the number of nodes in the computation grid, on the complexity of the geometry, and on the impurity profile. The base current can be calculated according to the TRAN 1 program of one-dimensional modeling, which allows separating the diffusion component of the recombination current in the base-collector region (Auger mechanism predominant) or in the collector junction region (Shockley-Reed-Hall mechanism predominant). A typical technology followed through by these programs successively involves antimony implantation in the substrate, antimony diffusion with oxidation, epitaxial growth, oxidation, boron implantation and diffusion with oxidation, and phosphorus implantation and diffusion. Figures 3; references 8: 7 Russian, 1 Western.
[118-2415]

INSTRUMENTATION AND MEASUREMENTS

UDC 621.373.826:621.396

INSTRUMENT FOR MEASURING DISPERSIONAL DISTORTIONS IN OPTICAL FIBRES AND CABLES

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 12 Jan 81)
pp 43-44

ALISHEV, Ya. V., MAR'YENKOV, A. A., SMIRNOV, Yu. V., URYADOV, V. N. and
SINKEVICH, V. I.

[Abstract] An instrument has been developed and built at the Minsk Institute of Radio Engineering for measuring the dispersive distortions in optical fibers and cables on the basis of pulse widening. The instrument consists of a laser as a light source, a master oscillator, an optical transmitter, an optical shunt with mode mixer, an optical receiver, a fiber length measuring device, a smoothly adjustable delay line, and a stroboscopic oscillograph. The optical transmitter contains a semiconductor laser with GaAs-GaAlAs diheterostructure and a modulator with pulse generating avalanche-breakdown transistors. The optical receiver contains a germanium photodiode with internal amplification and a photoreceiver amplifier with microwave bipolar germanium transistors. Matching of the instrument to the tested fiber line is done by passing radiation into the latter from an auxiliary small He-Ne laser through a directional coupler. The instrument performance characteristics are: duration of probing optical pulse 2 ns, maximum attenuation 30 dB, corresponding to minimum signal-to-noise ratio 20 dB at the oscillograph terminals to the length measuring device, maximum measurable length of fiber line 10 km, accuracy of length measurement within 5%. The instrument can be used in the driven mode with a synchronization confirming signal or in the servo mode without delay line, the length of the fiber line being in both cases determined from the total pulse travel time. Figures 3; references: 2 Western.

[98-2415]

MEASUREMENT OF COUPLING ADMITTANCE OF CYLINDRICAL SHIELDS

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 10 Nov 83)
pp 46-48

LIPSKIY, V. K.

[Abstract] The coupling admittance Y_c of a cylindrical shield and of the two coaxial conductors it separates is calculated, together with the coupling impedance Z_c , by solving the system of two telegraph equations for a four-terminal transmission line equivalent to the influenced circuit with distributed voltage sources. Separate measurement of this admittance is generally not possible, except with one end of the line shorted and the other end open when $|1/\sqrt{zy_{1,2}}| \ll 1$ (l - length of line) and the line is sufficiently short. For a measurement in this case, the admittance per unit length of the influencing circuit and the input impedance of the influenced circuit must be known. Figures 1; references 6: 2 Russian, 4 Western (1 in Russian translation).

[98-2415]

MICROWAVE THEORY AND TECHNIQUES

UDC 621.372.832.8

NONRECIPROCAL TWO-CHANNEL MICROWAVE POWER DIVIDERS AND ADDERS

Kiev IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: RADIOELEKTRONIKA in Russian
Vol 27, No 10, Oct 84 (manuscript received 12 Aug 83) pp 16-22

VAMBERSKIY, M. V. [deceased], USACHOV, V. P. and SHELUKHIN, S. A.

[Abstract] The performance of a nonreciprocal two-channel microwave power divider and adder is analyzed by the method of scattering and impedance matrices. The essential feature of such a passive device is decoupling of its one input arm from its two output arms by means of a ballast load in the fourth arm which absorbs all power of the wave reflected by the useful loads in both output arms. The efficiency of this device as a power divider and a power adder is calculated accordingly. A ferrite-disk resonator connected to four microstrip lines is considered as particularly suitable for this application. Its electrodynamic characteristics and geometrical design parameters are calculated from the corresponding system of 16 linearly independent equations with 16 real variables: 6 phase angles, 4 angular widths, 3 orientation angles, 1 disk radius, and 2 components of the magnetic permeability tensor. Figures 4; references: 4 Russian.

[118-2415]

POWER ENGINEERING

UDC 621.311.22.029.004.12

CHANGE IN TECHNICAL AND ECONOMIC INDICATORS OF POWER SYSTEMS WHEN OPERATING
AT LOWER FREQUENCY

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian
No 11, Nov 84 (manuscript received 24 Feb 84) pp 3-6

OKOROKOV, V. R., doctor of economic sciences, professor, and
POLIKARPOVA, T. I., engineer, "Order of Lenin" Leningrad Polytechnic
Institute imeni M. I. Kalinin

[Abstract] Frequency dips below the normal range in electric power networks, whether accidental or intentional, generally degrade not only the plant operation of the user but also the power generating plant operation. An earlier statistical study indicating a severe economic penalty paid for low-frequency operation has recently been supplemented with a study of 300 MW thermal electropower plant, for the purpose of tracing the losses through all affected components from turbine-generator set to station auxiliaries. A breakdown of economic penalties into direct (equipment malfunction and repair), extra (additional fuel consumption), basic (underutilization of manpower) and indirect (underutilization of equipment) units reveals that the extra fuel cost constitutes 80-85% of the total economic penalty. For refinement of this study, a cost comparison is made of plant operation with coal, natural gas, or heavy oil as fuel. The article was presented by the Department of Scientific Principles of Management. Figures 3; tables 1; references: 1 Russian.

[124-2415]

CONTROL AND MAINTENANCE OF ELECTRIC POWER QUALITY--AS IMPORTANT ITEM IN ECONOMIZATION OF FUEL AND ENERGY RESOURCES

Minsk IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: ENERGETIKA in Russian No 11, Nov 84 (manuscript received 13 Jun 84) pp 7-10

KAKHANOVICH, V. S., candidate of technical sciences, docent, Belorussian Order of the Red Banner of Labor Polytechnical Institute, and VERSHININ, A. S., engineer, Novopolotsk Polytechnic Institute

[Abstract] Considering that the quality of generated electric energy is a very important item in overall fuel and energy management, degradation of its quality having a tremendous detrimental impact on the national economy, an apparatus has been developed for quality control and maintenance by monitoring of the relevant performance indicators. This apparatus, designed specifically for 3-phase 50 Hz networks, consists of a current signal and voltage transducer, an input voltage divider, and a group of transfer switches for each phase, a common generator of test signals, a frequency multiplier, an array of analog memories, a multichannel voltage-to-code converter, a code averaging binary-decimal adder, a control module with computer and data output device, a storage for converted and averaged data, a frequency monitor, and a phase shift monitor. Depending on the position of the transfer switches, the apparatus can operate in either of three modes: 1) Monitoring basic quality indicators at two points in the network; 2) Monitoring at one point in the network not only the basic quality indicators, but also currents and parameters of the main power flux as well as the extra power flux covering nonisnuosidality of voltages and asymmetry of loads; and 3) Autonomous self-inspection with trapezoidal test signals having a known effective ripple. The three distinguishing features of this apparatus are: 1) Possibility of averaging the readings of any one parameter over 10 fundamental voltage periods, which reduces the random errors by a factor of $\sqrt{10}$ without decreasing the response speed; 2) Use of a voltage-to-code converter with channel transposition allowing an asynchronous and thus faster interrogation of channels; and 3) Use of a phase shift monitor for corrective action based on harmonic analysis excluding synchronization of the frequency multiplier. A prototype was built with series K153 and K155 integrated microcircuits for either one-shot measurements or cyclically repetitive ones (in 0.2, 0.5, 1, 2, 5, 15, 30, or 60 min intervals over 1, 8, 16, 24 h long periods or in continuous quality control). Most critical is the harmonic analysis of distorted voltage and current waveforms, provisions having been made for reading instantaneous values 18, 36, 72, or 144 times per fundamental voltage period. Article was presented by Chair (Kafedra) of TOE (probably Technical Department of Engineering). Figures 1; references: 5 Russian. [124-2415]

ENSURING ELECTRICAL SAFETY IN MOBILE ELECTRIC POWER PLANTS

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 11, Nov 84 (manuscript received 17 Nov 83) pp 30-34

BURALKOV, A. A., candidate of technical sciences, Krasnoyarsk Institute of Nonferrous Metals

[Abstract] Mobile electric power plants used for geological exploration as well as for oil, natural gas, and mineral extraction require special protective measures against electrical hazards to operating personnel which result from high ground resistance. Conventional grounding is not very effective in permafrost and desert regions as well as in moderate climates during winter. Metallic connections to the chassis and electric shielding meshes are used instead, in combination with Meggers for continuous insulation control. The performance of these safety devices is here evaluated on the basis of equivalent circuits corresponding to three principal most dangerous situations: 1) Person standing platform touches a phase wire; 2) Person standing on ground touches a phase wire; and 3) Person standing on ground touches the chassis or other component of the plant structure through which a phase has been shorted at some point. Expressions are derived for the current flowing through a person's body in each case, this current depending not only on the magnitude and the frequency of line or phase voltage but also on the circuit capacitances and conductances, assuming an electric power plant with isolated neutral. These expressions have been evaluated with numerical data characterizing conditions in Siberia, Central Asia, and the Carpathian Mountains. The effectiveness of safety devices in these regions has been established on this basis with attendant statistical analysis. The article was presented by the Chair (Kafedra) of Electrification of Mining and Metallurgy. Figures 2; tables 1; references: 3 Russian. [124-2415]

PARAMETERS OF COMPACT CONTROLLABLE TWO-CIRCUIT ELECTRIC POWER TRANSMISSION LINES OF CONCENTRIC STRUCTURE

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 11, Nov 84 (manuscript received 16 May 84) pp 10-15

POSPELOV, G. Ye., doctor of technical sciences, professor, Honored Distinguished Figure of Science and Technology of the Belorussian SSR, FEDIN, V. T., candidate of technical sciences, docent, SELIVERSTOV, G. I., engineer, and DUKHOVICH, G. L., engineer, Belorussian Order of the Red Banner of Labor Polytechnic Institute

[Abstract] A new structure has been proposed for overhead electric power transmission lines (USSR patent disclosure No 847,420 in 1981), namely

pairwise close-spacing of conductors from split phases of different circuits in a concentric two-circuit 3-phase arrangement. Here a design and performance evaluation of such a structure is made in accordance with fundamental relations in field and circuit theory, as a basis for optimization in terms of maximum capacity and maximum controllability as well as ecologically acceptable electric field intensity levels. Calculations for 110-220-330-500 kV lines using AS95/16, AS400/22, AS500/64, AS500/64 conductors, respectively, with the phase difference between input voltages to paired phases of the two circuits adjustable over the 0-180° range, have yielded the dependence of the nominal power and the maximum electric field intensity on the number of component split phases and on the radii of two concentric circles. The data needed for multiparameter design or performance control include effective inductances and capacitances, as well as wave impedances. The results reveal that in such a compact structure with equal numbers of conductors per phase and with the two circuits 180° out of phase in each conductor pair, for maximum transmission capacity, the total nominal power is determined principally by the number of conductors per phase in the outer circuit, the nominal power of the latter being proportional to its number of conductors per phase and almost independent of the radius of its phase splitting. The electric field intensity in such a structure with conventional conductor sizes and with the two circuits 180° out of phase in each conductor pair is maximum when the number of conductors per phase is largest ($n = 12$) and the radius of phase splitting in the inside circuit ($R_1 = 0.2$ m), up to 20.0 kV/m in a 500 kV overhead line. The range of regulating the electrical parameters by varying the phase difference between the two circuits can be widened with a larger number of conductors per phase and a larger radius of phase splitting in the inside circuit. The article was presented by the Chair (Kafedra) of Electrical Systems. Figures 2; tables 1; references: 5 Russian. [124-2415]

UDC 621.316.35.064.1

VIBRATION OF WIRES OF SPLIT PHASE ELECTRIC POWER LINES

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12, Dec 84 (manuscript received 5 Apr 84) pp 26-31

VAN'KOV, V. I., candidate of physico-mathematical sciences, docent, Moscow Order of Lenin, order of the October Revolution and the order of the Red Banner of Labor, higher technical school imeni N. E. Bauman

[Abstract] When constructing electrical power transmission lines for superhigh voltages the designers are faced with a problem of computing the split phase wires with supporting bars as a single mechanical system, elastic or viscoelastic, depending on the wire properties. Small oscillations near the point of static equilibrium (vibrations) of the wires in the split phase are discussed. Equations of motion are derived for the mechanical system of the split phase wire, including the supporting bars, whose mass can be neglected, compared to the mass of the wire in the split phase for each span.

Based on the kinematic hypothesis describing vibrations, the resulting system of differential equations in partial derivatives is linear, and therefore can be solved by the method of separation of variables. After conducting a theoretical study of the split phase free oscillations of two wires, it was possible to draw some conclusions concerning the particular features of their behavior for different orientation of the wires. Figures 2; references 4: 3 Russian, 1 Western.
[123-12755]

UDC 621.317.32

INVESTIGATION OF DEVELOPING A SERIES OF WIDEBAND VOLTAGE DIVIDERS USING MICROWIRE

Minsk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ENERGETIKA in Russian No 12, Dec 84 (manuscript received 1 Feb 1983) pp 31-36

GRIMAL'SKIY, O. V., engineer, and IVANOV, V. L., candidate of technical sciences, Order of the Power Engineering Cybernetics, Academy of Sciences, AS MSSR

[Abstract] Very stringent requirements are imposed on pulsed voltage dividers because of their broad area of application and operating conditions. A feasibility study was conducted for developing a series of dividers made of microwire for measuring high frequency and pulsed voltages which would allow measurements with errors not greater than 2%. A pulse divider was constructed with a high voltage and a low voltage compartments. Methods were developed for computing electric fields of the axisymmetric high voltage structures which allow field computations along the divider winding at the time the pulse voltage is applied. The relationship between the electric field intensity and the resistance per unit length was determined. Studies confirmed the feasibility of developing the precision wideband divider in the 0-5 MHz range using microwire with the measurement error not greater than 1%. Presented by the Department of Power Engineering Cybernetics. Figures 4; references: 3 Russian.
[123-12755]

ORGANIZATION OF PLANNING AND MANAGING EFFICIENCY USE OF FUEL AND ENERGY RESOURCES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 10, Oct 84 pp 2-3

SAVCHENKO, V. V., candidate of technical sciences, State Planning Committee of the Council of Ministers, USSR, and TIKHOMIROV, Yu. A., candidate of technical sciences, All-Union Scientific-Research Institute of Overall Fuel and Energy Problems, USSR State Planning Committee

[Abstract] A nationwide program is being organized in the Soviet Union to ensure economic and efficient allocation of fuel and energy resources. Standards have been developed and quotas have been established for this purpose by the USSR State Planning Committee, jointly with the State Committees on Technical and Material Aid and on Science and Technology of the USSR Council of Ministers. The major three aspects of this fuel and energy management are: 1) Technical measures; 2) Standardization of fuel and energy consuming equipment and machinery as well as of their performance indicators; and 3) Control of fuel and energy consumption according to regulations and with proper documentation. The program encompasses all concerned ministries and departments, all utilities and manufacturing enterprises.
[119-2415]

USE OF SECONDARY ENERGY SOURCES AS IMPORTANT FACTOR IN ENERGY CONSERVATION BY INDUSTRY

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 10, Oct 84 pp 4-6

SUSHON, S. P., candidate of technical sciences, and ZAVALKO, A. G., candidate of technical sciences, Scientific-Research Institute of Planning and Norms, USSR State Planning Committee, Ukrainian branch, GONCHAROV, Yu. A., engineer, USSR State Planning Committee, and RYZHNEV, Yu. L., engineer, USSR State Committee on Science and Technology

[Abstract] Use of secondary energy sources is an important item in the overall energy conservation program. The most promising method of its implementation by industry is transfer of heat from one product to another and from one process to the next in a technological sequence such as steel making, in utilities recirculation of waste heat carried by steam and hot water. The effectiveness of this program depends on integration of the electric energy produced or saved as a result in the overall power generation and consumption balance, and on the yield of such secondary energy sources as well as on the efficiency of their utilization. Its implementation has been included in the present Five-Year Plan with involvement of scientific research in goal setting, engineering design in equipment manufacture, and proper adaptation

of operating procedures by industry and utilities. The major problem of reconditioning low-grade waste heat is solved basically by means of heat compressors and heat pumps, which facilitate spontaneous evaporation of contaminated steam or other fluids under vacuum. There are other techniques available such as use of absorbents for refrigeration and use of refrigerants as turbine coolants.

[119-2415]

UDC [66:62-68].004.14

WAYS TO USE SECONDARY ENERGY SOURCES BY CHEMICAL INDUSTRIES

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 10, Oct 84 pp 6-9

ZHIZHIN, V. V., engineer, and KHARAZ, D. I., engineer, Scientific-Industrial Union 'Tekhnergokhimprom'

[Abstract] Combustible secondary energy sources, unlike noncombustible ones such as steam and hot water, are used directly and replace scarce fuel. They are used in various chemical industries, a typical one being production of yellow phosphorus, but by far not extensively enough and below their potential contribution to the fuel and energy conservation program. This is partly attributable to their preferred use for other purposes, especially as precious raw materials for various products. Thermal secondary energy sources such as steam and hot water are either used regeneratively by way of recirculation within a closed loop or in economizer equipment which transfers the heat to other systems. A major problem in the latter case is seasonal fluctuation of the heat demand, an excellent solution being installation of special equipment with absorbents such as LiBr and with air-cooled condensers for alternate heating during cold periods and cooling during hot periods. Another problem is reconditioning low-grade waste heat such as that of contaminated steam or hot water, this problem being solved with equipment which facilitates spontaneous evaporation of liquids superheated above their vapor-saturation temperature. The latter is most expediently converted to electric energy in the case of high-grade waste heat. Production of sulfuric acid and of nitric acid with their derivatives, and especially production of mineral fertilizers, are the main targets for more extensive use of thermal secondary energy sources. The reasons for their present underutilization by these industries are an insufficient amount of economizer equipment and an inefficient use of the existing one, combined with improper facilities layout, shortage of spare parts, seasonal fluctuation of steam and hot water production and their poor transportability. Locating the chemical industries near steam and hot water generating plants and development of more effective energy economizing schemes, with allocation of more plant space for economizer equipment, would be a major step toward better use of thermal secondary energy sources.

[119-2415]

MAIN TRENDS IN FUEL AND ENERGY ECONOMIZATION BY PETROLEUM PROCESSING AND PETROCHEMICAL INDUSTRY

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 10, Oct 84 pp 18-21

YERMOLOV, G. M., engineer, USSR Ministry of Petroleum Refining and Petrochemical Industry, GOLOMSHTOK, L. I., engineer, ZEN'KOVSKIY, S. M., candidate of chemical sciences, and VOSHCHINSKIY, A. A., engineer, All-Union Scientific-Research and Planning Institute of Petroleum Processing and Petrochemical Industry

[Abstract] Economization of fuel and energy by the petroleum industry is proceeding along three main lines: 1) Increased per-unit size and capacity of processing equipment; 2) combining of processes with elimination of redundant intermediate operations; 3) Reduction of energy waste throughout the production process by economy-oriented design and implementation of better technological energy transfer schemes. Outstanding illustrations of these trends are, catalytic cracking equipment, fractional distillation of petroleum residue in a single apparatus for all processes involved, and preheating low-pressure air together with high-pressure air with secondary energy sources such as flue gases or combustion products for subsequent heating of raw materials to processing temperature in the production of carbon or ethylene as typical examples. Furthermore, less energy is wasted by more efficient use of primary fuels in conventional tubular furnaces, better design of preheaters, economizers, and heat exchangers, computer-aided automatic control and continuous optimization of heat transfer, use of byproduct liquid-vapor mixtures as secondary energy sources, and use of heat pumps for selective evaporation of hydrocarbons. Improvements are still needed in condensate collection and reentry, in circulation of primary and secondary steam, changeover from steam driven pumps to electrically driven ones, changeover from steam to hot water for plant heating and ventilation, and more extensive use of solid-state (thyristor) exciters for synchronous motors with group self-restarting so as to ensure a higher reliability.

Tables 5; references: 4 Russian.

[119-2415]

QUANTUM ELECTRONICS/ELECTRO-OPTICS

UDC 621.315.2

DETERMINATION OF TWIST PARAMETERS WHICH DECREASE INTERMODE DISPERSION IN
SINGLE-MODE OPTICAL FIBER

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 (manuscript received 24 Jan 84)
pp 41-43

IVANOV, S. I. and TVOREMIROVA, T. A.

[Abstract] The effect of irregularities in single-mode optical fibers with birefringence on the polarization of transmitted light is analyzed, on the basis of Poincare's sphere, for the purpose of determining the critical amount of fiber twist which will ensure maximally distortionless circular polarization without intermode dispersion. The birefringence is expressed as the sum of two components, a linear one and a circular one, each determining the respective difference between phase velocities of two orthogonal modes. In turn linear birefringence consists of two components, because of change in the geometrical position of the fiber core and to nonuniformity of stresses at the core-sheath boundary. Twisting suppresses the linear birefringence, as demonstrated by the dependence of both of its components on the characteristics of the fiber core and reflective sheath (Young's modulus, Poisson's ratio, refractive index, transverse propagation constant, core ellipticity), as well as on those of light (wavelength, normalized frequency). The relations, reduced to engineering approximation, indicate a weak dependence of the twist pitch on the normalized frequency of light. They also indicate that linear birefringence increases with increasing anisotropy of transverse tensile stresses, which limits the twisting to a tradeoff for maximum circular polarization with minimization of linear birefringence practicably to below 10% of the circular one. Figures 5; references: 4 Western.
[98-2415]

NEW ACTIVITIES, MISCELLANEOUS

THIRTY-NINTH ALL-UNION MEETING DEVOTED TO RADIO DAY

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 pp 28, 63

ISHUTINA, L. N.

[Abstract] A traditional All-Union meeting was held in May 1984 in Moscow devoted to Radio Day. The meeting had been organized by the Scientific and Technical Society of Radio Engineering, Electronics and Communications imeni A. S. Popov, jointly with the USSR Ministries of Communication, Communication Equipment Manufacture, Radio Industry and Electronic Industry, as well as the USSR Ministry of Higher and Secondary Special Education, the USSR Academy of Sciences, and the USSR State Committee on Television and Radio Broadcasting. Over 300 reports were presented and discussed, covering the entire gamut of theoretical and practical aspects of radio from equipment development and manufacture to broadcasting technology. The most interesting ones among them were "Outlook for Development of Digital Television Broadcasting", "Role of Radio Electronics in Space Research" (co-authored by the Soviet astronaut G. V. Sarafanov), "Problems in and Outlook for Application of Electronic Technology to Food Production", "Mobile Ground-Surface Radio Communication in Service of the National Economy", and "Exploration of Venus Surface with Radar from Venera-15 and Venera-16 Space Probes". A few interesting presentations were given by foreign guests. In conclusion, recommendations were passed on to interested Ministries, academic institutions and technical societies regarding goals of the 11th five-year plan and their implementation in its fourth year.

[80-2415]

CONFERENCE OF EXPERTS IN COMMUNICATION ADMINISTRATION--MEMBERS OF ORGANIZATION FOR COOPERATION OF SOCIALIST COUNTRIES IN THE FIELD OF TELECOMMUNICATION AND POSTAL SERVICE

Moscow ELEKTROSVYAZ' in Russian No 8, Aug 84 p 53

YAMPOL'SKIY, V. G.

[Abstract] A conference was held in May 1984 in Czechoslovakia by the Organization for Cooperation of Socialist Countries in the field of

Telecommunication and Postal Service (OSS) on "Study and Development of Norms for Parameters of Antennas in Radio Relay Links with Consideration of Electromagnetic Compatibility". The participating countries were Bulgaria, Czechoslovakia, GDR, Hungary, Poland and the Soviet Union. Reports were presented and discussed covering the most important theoretical and practical aspects of this problem. Antenna measurements and problems with use of antennas in radio relay links were the subject of reports by the experts from Czechoslovakia. Methods of high-precision measurement and possible sources of error were the subject of reports by the experts from Hungary. The feasibility of improving local and integral interference immunity was the subject of reports by the experts from the GDR. Parasitic antenna radiation, its effects on the technical performance parameters of communication lines and problems in reducing it were the subject of reports by the experts from the Soviet Union. All delegations agreed on the importance of and the need for norms pertaining to antennas in radio relay links, the underlying basis for such norms having been established at this conference. [80-2415]

TO INCREASE EFFICIENCY OF BRIGADE FORM OF ORGANIZATION AND RENUMERIZATION OF LABOR

Moscow VESTNIK SVYAZI in Russian No 11, Sep 84 pp 2-5

LEBEDEV, V. N., Deputy Minister of Communications, USSR

[Abstract] The brigade form of organizing and stimulating production, increasing the efficiency of labor, encouraging worker participation in management and expanding their fields of activity are discussed. This concept has been promoted by the resolutions of the XXVI meeting of the party and by subsequent plenary sessions of the CC CPSU. New types of brigades, the complex, and the reenforced-complex, some operating on profit and loss (khozraschet) principles also continue their expansion in the communication sector. At the present time about 60% of the Country's labor force is organized in brigades. Because of the characteristic features of the communication field only 35% of the communication workers can potentially participate in the new type of brigade. The greatest progress in forming the brigades was recorded in some western regions of the USSR, whereas certain other regions are lagging behind. Several measures were suggested for encouraging the formation of brigades. Among them is the promotion of a scientific approach to organizing labor, combining and acquiring new professions for the workers and a judicious selection and training of the brigade leaders. Despite certain cited shortcomings and examples of local inefficiency, the overall productivity vs. remuneration was increased in many sectors because of the implementation of the brigade concept. An annual saving of 8.6 mil. rubles was achieved and it became possible to reduce the workforce in the industry by about 6 thousand. The personnel turnover was also reduced. Efforts to convert to profit and loss (khozraschet) accounting continue, although some difficulties are encountered. [122-12755]

DIGITAL TECHNIQUE IN RADIO BROADCASTING

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 pp 62-63

GITLITS, M. V.

[Abstract] A scientific-technical seminar was held in May 1984 in Leningrad on "Digital Technique in Radio Broadcasting". It was organized by the Scientific and Technical Society of Radio Engineering, Electronics and Communication imeni A. S. Popov, through a joint effort of its Central and Leningrad offices, and it was attended by about 90 experts from 10 Soviet cities. The first topic discussed was a proposal for setting up a digital radio broadcasting base in the Soviet Union. This was followed by problems of hardware, specifically high-precision analog-to-digital converters for high-fidelity error-immune sound (music) recording equipment. Another topic was feasibility of digital radio broadcasting in an assigned metric wave band, possibly by applying the method of twofold inverse Fourier transformation. Processing of signals and simulation of broadcasting algorithms such as compression of audio signals by computers or minicomputers, respectively, were finally considered. The participants agreed that introduction of the digital technique will improve the quality of radio broadcasts and will broaden the scope of radio programs.

[98-2415]

REGIONAL SEMINAR ON PROBLEMS OF SYNCHRONIZATION

Moscow ELEKTROSVYAZ' in Russian No 9, Sep 84 pp 63-64

PESTRYAKOV, A. V.

[Abstract] A scientific-technical seminar was held at Gorkiy in June 1984 on "Problems in Study of Synchronization Systems by Qualitative-Numerical Methods". It was organized by the Scientific and Technical Society of Radio Engineering, Electronics and Communication, imeni A. S. Popov, namely its Central and Gorkiy offices, jointly with the Scientific-Research Institute of Applied Mathematics and Cybernetics at the Gorkiy State University. Altogether 30 papers were presented on improvement and extension of qualitative-numerical methods for synchronization systems and devices, development of promising phase synchronization systems, microprocessor-aided problem analysis, analysis of multivariate and multiply-connected synchronization systems such as integrated ones, frequency methods of analyzing phase synchronization systems, synchronization in self-excited oscillatory systems, synthesis of optimum synchronization system structures, and synchronization in aviation communication channels. It was recommended that, as a stimulus for scientific activity in this area, more article on the subject be published in ELEKTROSVYAZ' and RADIOTEKHNIKA.

[98-2415]

- END -

END OF

FICHE

DATE FILMED

1 APRIL 85